APPLIED HYDRAULICS

OCTOBER 1954

THE MAGAZINE OF
FLUID POWER
INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

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FRANCHISE CIRCULATION

Here it is—

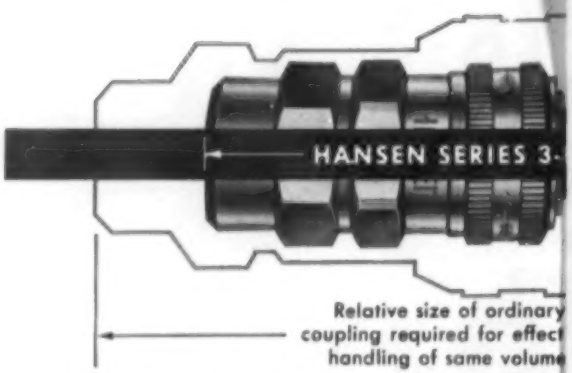
THE NEW

HANSEN

SERIES 3-RL

QUICK-CONNECTIVE

RING-LOCK COUPL



Relative size of ordinary
coupling required for effect
handling of same volume

WA
PAG

Effectively handles far
coupling of equal dime

Tough, compact, smaller, the new Hansen S
Coupling will handle any job in your shop usi
connections—from the air line to the air tool.
is there any need for various sizes of couplings
points in your hook-up. The Hansen Series
completely interchangeable sockets and pl
all—makes it easy to keep stock of parts in bala
inventories to a minimum.

Carefully designed, the Hansen Series 3-RL combines maximum flow with compact construction. Sockets are brass with steel sleeves—plugs are steel. Sockets for use with small hand-operated air tools are available in aluminum.

Write for Descriptive Literature

Metal to Metal Contact

• Equipped with automatic sleeve lock, the Hansen Series 3-RL Coupling is quickly and positively connected merely by pushing plug into socket. To disconnect, just turn the sleeve. Locking ring in socket is forced into groove in plug, provides practically 360° metal to metal contact, reduces wear, and insures tight fit.

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4031 WEST 150th STREET • CLEVELAND 11, OHIO

Circle 86 on Reade Service Card

for

Exacting

CYLINDER

CONTROL

AVY

iES

¼" UNITITE JR. VALVES

Hanna ¼" Valves control air, oil or water pressures up to 500 p.s.i. The control lever requires only 80° movement for reversal. Hanna ¼" Valves are 4-way but can be made 3-way, by plugging one port. Three models — column, standard and manifold mount—are available. Ideal for tubing and light piping.

ELECTRIC VALVES

The Hanna 4-way Solenoid Valve is small, compact, with low current consumption. It is adaptable to straight line piping—capacity is equal to rated pipe size. Of balanced spool type, it has a built-in solenoid pilot valve. Piping may be from bottom, sides or a combination. Available in ⅜", ½", ¾" and 1" pipe sizes.

valves

SPEED CONTROL VALVES

Hanna Flo-Set Valves have micrometer graduations to assure exacting speed control. Available in ¼", ⅜", ½" and ¾" sizes, they are suitable for air, oil or water control, with maximum pressure to 250 p.s.i. They may be mounted in any position.

UNITITE VALVES

Unitite Valves are suitable as either 3-way or 4-way valves, operating at air, oil or water pressures up to 250 p.s.i. for the ⅜", ½", and ¾" sizes . . . up to 150 p.s.i. for the 1" size . . . and up to 100 p.s.i. for the 1¼" size. Three styles—for standard mounting, column mounting or manifold mounting—are available.

FOOT OPERATED VALVES

Available in ⅜", ½", ¾" and 1" pipe sizes, Hanna Foot Valves are ideal for applications where it is desirable to have the operator's hands free for handling material. Single-pedal and double-pedal models, for pressures up to 250 p.s.i., are available for use with double-acting air and hydraulic cylinders.

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Write today for the new illustrated Hanna Valve Bulletin No. 257.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1741 Elston Avenue, Chicago 22, Illinois

Here it is—

THE NEW

HANSEN

SERIES 3-RL

QUICK-CONNECTIVE
RING-LOCK COUPLING

Relative size of ordinary coupling required for effective handling of same volume

Effectively handles far more volume than any coupling of equal dimensions

Tough, compact, smaller, the new Hansen Series 3-RL Coupling will handle any job in your shop using ¾" to ⅛" connections—from the air line to the air tool. No longer is there any need for various sizes of couplings at different points in your hook-up. The Hansen Series 3-RL, with completely interchangeable sockets and plugs does it all—makes it easy to keep stock of parts in balance—holds inventories to a minimum.

Carefully designed, the Hansen Series 3-RL combines maximum flow with compact construction. Sockets are brass with steel sleeves—plugs are steel. Sockets for use with small hand-operated air tools are available in aluminum.

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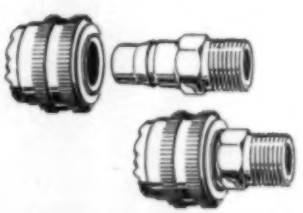

POSITIVE LOCKING

Ring Lock Provides Practically 360° Metal to Metal Contact

• Equipped with automatic sleeve lock, the Hansen Series 3-RL Coupling is quickly and positively connected merely by pushing plug into socket. To disconnect, just turn the sleeve. Locking ring in socket is forced into groove in plug, provides practically 360° metal to metal contact, reduces wear, and insures tight fit.

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Hanna® valves

CHOOSE FROM a broad selection of Hanna Valves to meet your requirements for exacting Air and Hydraulic control. Illustrated are but a few of the complete line of hand, foot, electric and pilot operated valves for directional and speed control. They all carry the Hanna nameplate—an assurance of extraordinary care in design and manufacture—which means years of maintenance-free operation. Your Hanna sales representative offers specialized experience in selecting valve combinations and developing control circuits.

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Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1741 Elston Avenue, Chicago 22, Illinois

VOLUME 7 NUMBER 10

APPLIED HYDRAULICS

OCTOBER 1954

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BPA

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QUAD RINGS

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O-RINGS—full line of sizes. Made by Minnesota Rubber, world's largest manufacturer of rubber O-rings. Exclusive Minnesota Rubber injection molding process eliminates flash and weakening trimming blemishes on sealing surfaces (ordinary O-ring problems). Rubber density is higher, structure is tougher—yet prices are lower than the industry average!

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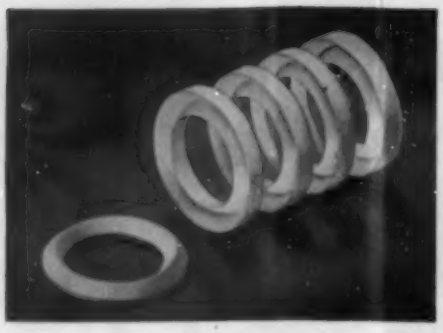

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An extremely anti-hesive, anti-friction, non-absorbent, chemically inert, non-flammable material for service temperatures from —110°F to plus 500°F. Offered in sets with square-end TEFLON adaptors. Ask for Bulletin No. TP-1053.

Other U.S.G. Engineered Packings...

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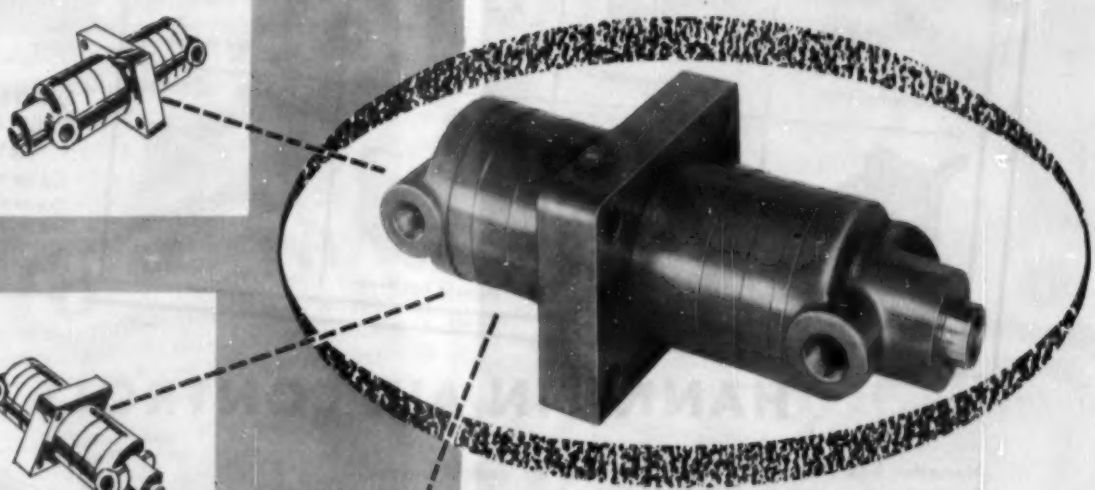
with the NEW . . . MORE VERSATILE INTERMEDIATE FLANGE MOUNTING



YOU CAN CHOOSE THE POSITION BEST SUITED TO YOUR OPERATION

Now you can have complete freedom of decision on mounting Pathon Hydraulic Cylinders on your machinery without special mounting brackets. The Standard Pathon Intermediate Flange mounting is rotatable to any position to permit mounting with pipe parts in any position. Available in both the R.H. 2000 P.S.I. and Q.H. 1000 P.S.I. Series, it combines all the important advantages of all Pathon Hydraulic Cylinders.

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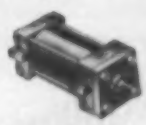
Made in 11 bore sizes from 1½" to 14"...13 standard mountings...many combinations. Extremely close tolerances insure accurate, easy mounting. Steel heads. Cylinders of hard-drawn, high strength brass honed to a satin finish. Piston rods ground and polished then hard chrome plated for extreme smoothness as well as corrosion resistance.

TYPICAL MOUNTING STYLES

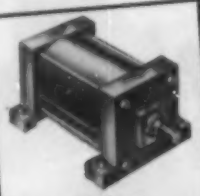

Centerline Lugs

Clevis Mounted

Rod End Flange

Blind End Flange

Double Rod End


Side Lugs

Holes in Rod Head

Angle Mounted

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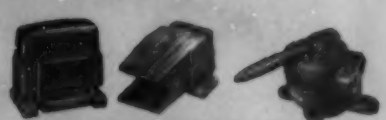

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Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation.

P-M PILOT-MASTER VALVES

The P-M line provides faster, easier operation for the simplest to the most complicated air-operated circuit. 2-Way, 3-Way and 4-Way Master Valves and Solenoid Pilot-Master Valves...also direct operated 3-Way and 4-Way valves with a wide choice of operating heads.

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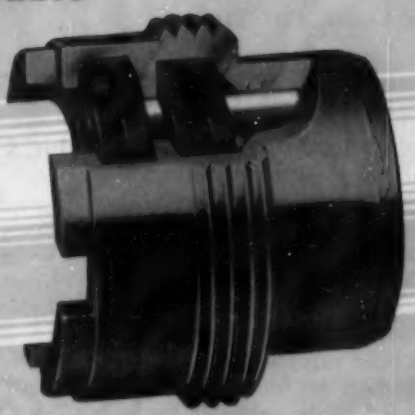
TYPE CYLINDERS

BOTH WITH NEW, CARTRIDGE GLAND

...externally removable and replaceable without dismantling cylinder!



Here's the biggest improvement in cylinder design in the last 50 years. This exclusive Hannifin gland is a bronze cartridge, externally removable and replaceable as a unit to meet J.I.C. recommendations. A face type spanner wrench is the only tool you need. Now look at the packing! The "Wiperseal" serves a dual purpose as it wipes both ways to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. The "Lipseal" is self-compensating, self-relieving and non-adjustable... provides an efficient seal throughout its long life. Ask for a demonstration... every Hannifin man carries a cutaway sample of this "jewel" of a gland with him at all times.

SERIES "H" HYDRAULIC CYLINDERS

Made in 9 bore sizes from 1½" to 8"... 13 standard mountings... many combination mountings. Extremely close tolerances for easy mounting. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished then hard chrome plated for minimum friction and long packing life.

TYPICAL MOUNTING STYLES

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Get your copy of this complete, easy-to-use catalog today. Everything you need to order from is here.

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Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

APPLIED HYDRAULICS Fluid Power Lines

1954 APPLIED HYDRAULICS Contest Winners

At the October 15th luncheon meeting of the NCIH in Chicago, checks for the $500, $300 and $200 prize papers will be presented to the winners. Winners of the $1200 in cash awards are announced in the prize paper section starting on page 69. These winning papers were selected by the judges on the basis of their practical and economic value to the fluid power field. There are many excellent design, production and maintenance ideas included in all the papers which were submitted. Contest judges were D. F. Green, chief engineer, Williams-White & Co.; Frank L. Mackin, General Motors Institute and John T. Marshall, chief engineer, Hamilton Division, Bendix Aviation.

Because the judges indicated that many of the papers which did not win awards merit publication, many men who submitted papers will see them in print during the coming year. Congratulations to the winners, and our thanks to everyone who entered this year's contest.

10th Anniversary of NCIH

Back in 1945, about 100 men accepted the invitation of the Graduate School and the Armour Research Foundation of the Illinois Institute of Technology to attend a conference designed to provide a common meeting place for engineers interested in industrial hydraulics. The name "National Conference on Industrial Hydraulics" was later adopted. This year about 700 engineers will attend the 10th anniversary meeting of the NCIH in Chicago on October 14 and 15. The conference is now sponsored with the cooperation of nine technical societies, two trade associations and over 100 industrial organizations.

During this year's two day conference, 18 papers covering 10 different fields will be presented. Recognizing the close relationship of pneumatic problems, one session on pneumatics is being included in the program for the first time this year. You'll find the complete program described on pages 64 and 65. Summaries of most of the papers are published in this issue. If you are attending the conference, the summaries will help you select the sessions you wish to attend. For those of you who cannot come to Chicago, this issue will give you an excellent summary of the formal papers. We'll tell you about the panel discussions after the conference, and if you want to know more about any specific papers send us a note.

Busy Little Robot

It's getting so, that the auxiliary automatic handling equipment between automatic machines in an automatic line can be more fascinating than the main machines. As we saw one of the devices built by Hautau Engineering Company go into action, we had visions of a multi-armed worker moving with incredible speed. Apparently we aren't alone with such imaginative thoughts because one of the loaders Hautau builds is called the "Octopus". In this issue, Hautau engineers, Bruce Barton and Jack Grimm, tell about the design of one of their oil powered loaders.

About Back Pressure

Johnny Pippenger has been active in the hydraulics field for many years and is now vice president of Double A Products Co. Because his business is valves, the effects of back pressure are of great concern. Sometimes valve operation depends on back pressure; often back pressure reduces valve life and impairs operations. In his article, John tells about the effects of back pressure and describes valve designs and gives circuit suggestions to eliminate or minimize the difficulties which could result from back pressure.

Servos in the Shop

More and more, hydraulic servo devices are being used on shop equipment where they are operated and maintained by regular shop personnel. While the accuracy and response demands on these devices are not as stringent as some of the servos used in aircraft or computer applications, the servo principle is the same and the principle is used to excellent advantage. One typical shop installation is described in this issue by Walt Carruth, machine designer at Chevrolet-Cleveland. They solved a positioning problem with equipment which can be adapted to many industrial jobs. After you've read Walt's article, look over the heavy positioning fixtures in your shop. Perhaps here's a way for you to reduce operator fatigue and provide safe, accurate positioning.

Precision "O" Rings and Dyna-seals are solving new design problems every day!

Precision "O" Rings
—carefully inspected, high quality, tough, compression molded!

Precision Dyna-seals
—for sealing under bolt heads, rivets, flanges, circular flat surfaces—no groove necessary.

THEY LICK LEAKAGE!

Shown here are just a few among the hundreds of today's successful designs that employ *PRECISION "O" Rings* and *Dyna-seals* for simplicity, economy and leak-free service. Let *Precision* engineers help with your design. Write for *free* Handbook of valuable "O" Ring and Dyna-seal data!

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FACTS on NON-FLAMMABILITY *and* UCON Trade-Mark hydrolubes

WHAT... *are Ucon hydrolubes?*

Ucon hydrolubes are safety hydraulic fluids. They are balanced formulations of water, a synthetic lubricant, an anti-freeze, and selected inhibitors. The water content is the key to their non-flammability.

WHO... *should use Ucon hydrolubes?*

Any one who has hydraulic lines or equipment around potential sources of ignition.

WHERE... *can Ucon hydrolubes be used?*

In die-casting machines, combustion control regulators, hydraulic welding machines, ingot manipulators, and other equipment.

WHY... *should I choose Ucon hydrolubes?*

Because the resistance of Ucon hydrolubes to burning has been proved by years of severe, exhaustive testing in the laboratory. AND, in *actual service*, Ucon hydrolubes have prevented fires and serious damage during their more than 6 years of routine use.

and UCON hydrolubes...

* Have no harmful effects on packings and seals. Leakage losses are often lower than with regular hydraulic fluids.
* Contain effective liquid- and vapor-phase corrosion inhibitors for the common metals.
* Have good lubricity. Special anti-wear agents provide satisfactory pump life and performance characteristics.
* Are made in 3 viscosity grades—200, 300, and 550 S.U.S. at 100° F. Other viscosity grades can be supplied to fit specific requirements.
* Have high viscosity indexes—150 to 160.
* Have low pour points—below minus 55° F. Ucon hydrolubes flow readily at low temperatures.
* Are non-toxic for all practical hydraulic purposes.
* Are water-soluble. Spillage is easily washed away.

HOW... *do I change over to Ucon hydrolubes?*

By draining the old fluid from your system, following the cleaning procedure that Carbide recommends, and refilling. You don't have to revamp your equipment.

WHEN...

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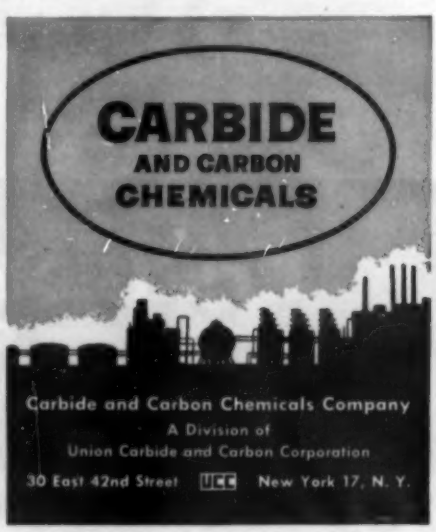

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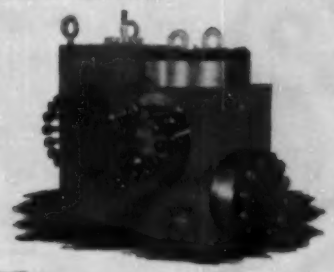
LOMBARD
'ROUND THE WORLD

Throttle & Inlet Valve



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HIGH PRESSURE 6000 P.S.I. **!**
BALANCED DESIGN!
LARGE SIZE RANGE!

Filling Valve

A Complete Complimentary Line of

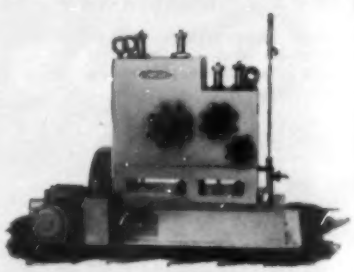
HYDRAULIC VALVES

- CONTROLLED CHECK VALVES
- THROTTLE VALVES
- FILLING VALVES
- STOP VALVES

featuring

ELECTRICALLY OPERATED
CONTROL VALVES

Control Valve



Here's What It Means:

1. Insurance against operator error
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6. Balanced valves (ease of operation)
7. Press speed control
8. A variety of safety interlocks

Inquiries Invited

LOMBARD CORPORATION
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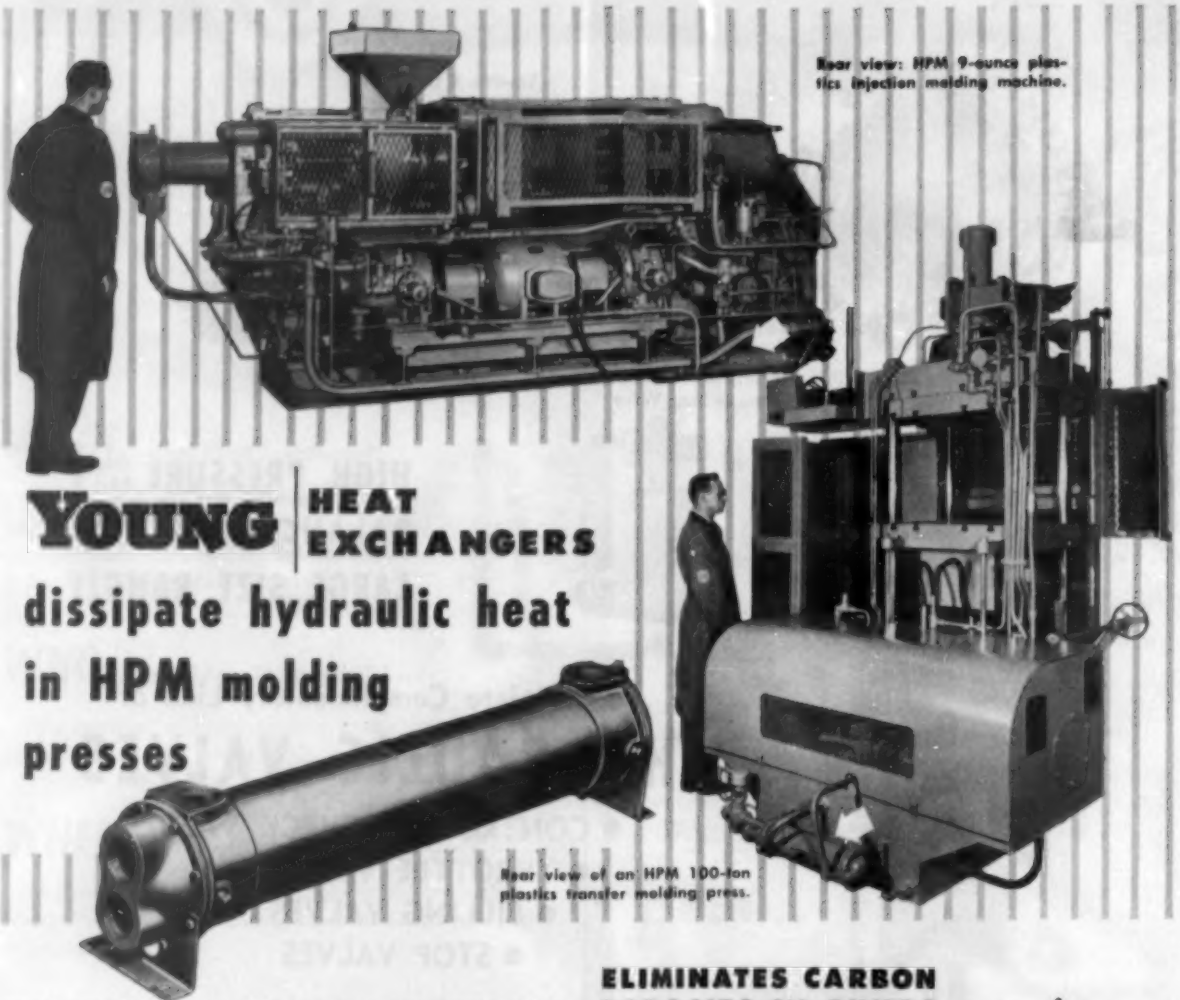
YOUNGSTOWN, OHIO

ONE SOURCE FOR COMPLETE HIGH PRESSURE HYDRAULIC CONTROL AND ACCUMULATOR SYSTEMS



Rear view: HPM 9-ounce plastics injection molding machine.

Rear view of an HPM 100-ton plastics transfer molding press.

YOUNG HEAT EXCHANGERS dissipate hydraulic heat in HPM molding presses

THE HYDRAULIC PRESS MANUFACTURING COMPANY, Mount Gilead, Ohio, specifies low cost Young Type "F" Heat Exchangers to reject heat generated in compression of hydraulic oil. Heat is built up as liquid plastic at 300 to 500° F., is forced into the mold chamber on the plastic presses. The Young Coolers maintain a maximum operating temperature of 115° F. in the hydraulic fluid under this severe service! This removal of heat is accomplished with minimum pressure drop using a minimum of water. Young Heat Exchangers are available in fixed and removable tube bundle models for either fresh or salt water service. For further details see your nearest Young Representative or write direct.

ELIMINATES CARBON DEPOSITS IN PUMPS

Where input horsepower and loads are high, Young Heat Exchangers reject the generated heat . . . and prevent the possibility of carbon formation in pumps.

MAINTAINS VISCOSITY OF HYDRAULIC OILS

Young Heat Exchangers maintain oil at working temperatures . . . eliminate the breakdown of the oil through correct sizing in Heat Exchanger cooling capacity.

Heat Transfer Products for Automotive, Agricultural, Industrial, Gas and Diesel Engine Application.

YOUNG

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY
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Shell and Tube Heat Exchangers | Automotive and Industrial Radiators | Unit Heaters | Convector Radiators | "YAC" Air Conditioners | Heating and Cooling Coils | "HC" Cooling and Condensing Units

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- **All steel construction—no tie rods, no castings.**
- **Hard chromed and ground piston rod to resist abrasion and prolong seal life.**
- **Self adjusting seals.**
- **Five standard mountings.**
- **Ample rod guide.**
- **Rod wiper seals fitted as standard.**
- **Cushioning at either end or both ends of stroke.**
- **Stroke length to suit your application.**
- **Standard range 2" to 6" bore, double acting.**
- **For working pressures up to 1,500 p.s.i.**
- **Double ended rods available for all standard cylinders.**
- **Special mountings, larger bores and cylinders for higher pressures by arrangement.**

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4H/61

GROWING HORIZONS FOR FLUID POWER

NEWS • ACTIVITIES • PLANS

SLIDE-LECTURE PROGRAM is very effective in training designers and machine repairmen in the operation of hydraulic components. The Denison Engineering Company has completed slide-lectures on pumps, motors and valves. The lectures are available to colleges, engineering societies and company training programs. From six to 15 four-color slides are used to describe the operation of the hydraulic units in this series.

INTERNAL REVENUE ACT OF 1954 contains two new options for depreciation of machines which will increase incentive for modernization. Depreciation allowances will now be more in line with the real useful and profitable life of production equipment. A company may write off machine tools at a faster rate than the straight-line method by using the double declining balance method, under which a company can write off about two-thirds of the original cost in the first half of a machine's tax life; or by using the sum of digits method, under which a company can write off about three-fourths of the original cost in the first half of a machine's tax life.

SUBSTANTIAL EXPANSION of The Texas Company's research and technical activities is being undertaken. A new independent research and technical department will carry on a broad program ranging from basic work in physics, chemistry, and engineering, to the continuous development of new products and processes.

THREADLESS SUBPLATES for gasket mounted valves are being successfully applied with considerable reduction in maintenance. Gasket mounting, which is encouraged by JIC standards, permits valves to be removed and replaced without disturbing piping connections, allows concealment of piping and eliminates pipe taps in valve bodies. Conventional subplates require tapping. A new threadless subplate has three elements, an insert, a lockplate and base plate. No tapping is necessary and the base plate is not subject to direct hydraulic pressure.

MORE TEFLON will be available as the result of plant expansion being carried on by Du Pont. Since 1950, when Du Pont began the first commercial scale manufacture of Teflon, this new plastic has become an important packing material. Its use in the hydraulic field is only one of many applications for this material. Problems involving the reduction of friction are being solved by products using Teflon.

A $6000 GRANT FOR RESEARCH in the field of hydraulics and hydraulic machinery has been established at Illinois Institute of Technology, Chicago, by the Giddings and Lewis Machine Tool Company, Fond du Lac, Wis. Announcement was made by Edgar L. McFerren, the company's vice president in charge of engineering, who also named the first recipient of a graduate research fellowship under the grant. The fellowship winner is Charles A. Sotich of Chicago. One third of the grant will cover the fellowship, while the remainder is used to further research at the school.

Diversatility rides again

in the new COMPLETE line of SPEED KING

Valvair Solenoid Pilot Operated Control Valves

Valvair Speed Kings are small, light in weight, with a speed of 600 cycles per minute, and proven capable of 20,000,000 cycles and up.

The New Valvair Speed King line is complete — 3-way, 4-way, and 4-way-5-port (2-pressure), foot-mounted or sub-base manifold mounted; pipe sizes — ¼", ⅜", ½", ¾", 1". *COMPLETE* — to fit almost innumerable applications. A precedent-breaker in size, weight, speed and endurance. Only two moving parts. Non-corrosive materials throughout. Solenoid and pilot valve parts are totally enclosed, but easily accessible. *Get all the facts!*

VALVAIR CORPORATION *Affiliate: Sinclair-Collins Valve Company*
951 BEARDSLEY AVE., AKRON 11, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

Rely Upon Valvair DIVERSATILITY

Ask for Bulletin "AH-9"

GROWING HORIZONS FOR FLUID POWER

HYDRAULIC POWER is finding its way into the nation's fairgrounds. At Springfield, Illinois the Weaver Manufacturing Co. was called on to design a hydraulic stand for judges of the harness, automobile and motorcycle races at the fairgrounds. They built a metal platform which is operated by two, pushbutton controlled, cylinders which raise the platform into position at race time and lower it during the off periods. The platform moves up slowly to a height of eight feet and then swings out three feet over the track. There is plenty of clearance for horses and motor vehicles.

FIRST U.S. AIR FORCE OPERATIONAL AIRCRAFT to be equipped with a fire-resistant hydraulic fluid are the C-118A's being produced at the Santa Monica, Calif., plant of the Douglas Aircraft Company. Additional C-118A's already in service will be converted in the field by the Air Force. All of the giant long range troop and equipment carriers, military versions of the Douglas Liftmaster, have been assigned to the Military Air Transport Service.

SHORTAGES OF ENGINEERS will push the automatic factory into reality. That is the opinion of David Rubinfien, supervisor of the Computer center at Armour Research Foundation of Illinois Institute of Technology, Chicago. The need for engineering personnel already has been alleviated by computing machines, he pointed out. Factors which Rubinfien sees bringing increased use of automatic equipment are the inability of humans to perform certain jobs with adequate speed; lack of safety in some industrial activities, and high cost of human participation in some factory areas.

BY 1975, MORE THAN $200 BILLION of capital equipment in this country will be more than 10 years old. These figures presented by S. D. Maddock, president of C.I.T. Corporation, indicate a rising demand for machinery. Replacement expenditure will amount to an estimated $26.7 billion by 1975. "Expenditures for replacement of old equipment would exceed these estimates impressively," Maddock said, "if industry weeded out all the obsolete and outworn machinery being used."

ELECTRONIC DATA COMPUTERS are creating a new standard of lead time in the design of hydraulic units. A two day conference, sponsored by the Armour Research Foundation of Illinois Institute of Technology in Chicago, November 8 and 9 will devote the second day of the meeting to engineering applications of hydraulic valve design, servomechanisms and controls. The first day of the conference will be devoted to business applications of computers and a training program for preparation in the use of computers.

"AIR AND OIL CYLINDERS IN INDUSTRIAL APPLICATIONS," a new book, may be a surprise to many users who may have considered cylinders merely as end-of-the-line units to be "selected" after computations have been carefully made for other elements in hydraulic and pneumatic circuits. Design characteristics, selection factors and applications of cylinders for efficient service are presented from a fresh, practical point of view based on an extensive background of work with industrial users of cylinders. The book sells for $5.00 and may be ordered from APPLIED HYDRAULICS.

FOR OVER TWO YEARS interest in the series Beginner's Course in Basic Pneumatics, published in this magazine, has grown. Before the last installment appeared in June of this year, there have been scores of requests for reprints, not only from individuals but also from manufacturers who have found the material valuable for their own company training programs. In response "A Beginner's Course in Basic Pneumatics" has been reprinted in booklet form, with some rearrangement, corrections and additions. Copies will be available after October 1.

PNEUMATIC REGULATION of automatic variable-speed electric motors will be shown at the 21st National Exposition of Power and Mechanical Engineering at Philadelphia, December 2-7. One pneumatic control operating at 60 to 100 psi is positively positioned by a piston having both sides under working pressure and regulated by a pilot valve under 3 to 15 psi signal pressure.

Do You Get All This...

when you buy hydraulic packings and fluids?

- ☐ Compatibility—kind to each other
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- ☐ On-time delivery, with adequate stocks of standard items
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FIRST, because we have every type of packing you need including synthetic rubber, leather and the new Houghton-Developed rubber-impregnated leather packings.

SECOND, every type: Cup, flange, U, V, including O-rings, washers, discs and gaskets . . . for oil, air, water and gas applications for all pressures and for temperature up to 2000°F.

THIRD, we're the only packing manufacturer also supplying all types of hydraulic fluids . . . reinforced petroleum base oils . . . lubricant additives for water systems . . . and the new Houghto-Safe non-flammable hydraulic fluid.

MOREOVER, we give you complete engineering service to match Houghton quality packings and fluids. Ask the Houghton Man about it.

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Ready to give you on-the-job service . . .

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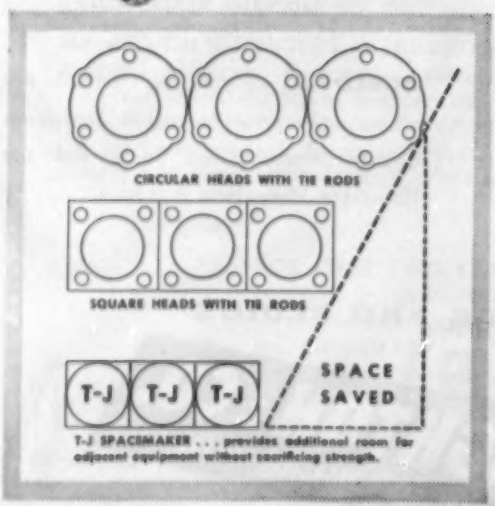
New

COMPACT DESIGN SAVES UP TO **40%** SPACE!

Proven

PERFORMANCE WITH EXTRA HIGH SAFETY FACTOR!



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

T-J Spacemaker CYLINDERS

OIL pressure to 750 — AIR to 200 P. S. I.

Now the sensational new T-J Spacemaker sets the pace in compact cylinder design and efficient performance!

New "Self-Aligning" adjustable oil cushion means faster acceleration and better cushion than ever before . . . New T-J Super Cushion Flexible Seals for air insure positive cushion with automatic valve action for fast return stroke.

More plus features include—heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, high-tensile, *hard chrome plated piston rod.* Write for bulletin SM-454-2. The Tomkins-Johnson Co., Jackson, Mich.

T-J **TOMKINS-JOHNSON**

RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

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Circle 128 on Reader Service Card →

Now . . .

greater performance

from Hydraulics!

Pantex

¼" Directly Operated 4-Way Valve

Solenoid Controlled

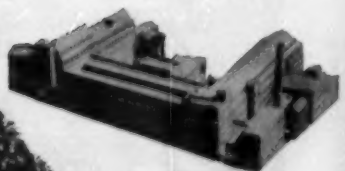
100-5,000 p. s. i.

This Pantex 4-Way Valve, operating at pressures up to 5,000 p.s.i., can be easily mounted on *existing* lower pressure installations where a higher pressure is desired.

Most Compact,
sub-plate mounted.

Detachable Coils,
quickly, inexpensively replaced.

Low Inrush Ampere Factor,
much less than others.



Also available—

Relief Valves
350 — 5,000 p.s.i.

¾" Pilot Operated 4-Way Valves
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¾" Pilot Operated 4-Way Valves
Solenoid Controlled
100 — 5,000 p.s.i.

. . . hydraulic control specialists . . .

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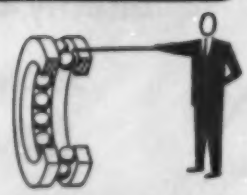
MANUFACTURING CORPORATION
PAWTUCKET, RHODE ISLAND

since 1927

FINEST SWIVEL FITTING ON THE MARKET TODAY

Thrust bearings for thrust loads



out-performs on every job — yet costs no more

STYLE S U.S. TYPE

Grooved packing for high temperatures or corrosive services.

Lip type packing for high pressures.

Throughout the world, you'll find EMSCO Ball Bearing Swivel Fittings on vital installations where safety, free-turning and low resistance to flow are essential.

Compare EMSCO ball race design — thrust bearings for thrust loads. Compare the method of sealing against leakage—an isolated packing chamber in which is retained the type of packing most suited to the job. Fitting breaks like a union for easy inspection or replacement of packing.

You profit directly from these features — the result of years of engineering know-how built into every EMSCO fitting. If you're not already using EMSCO, better send today for latest catalog and prices.

EMSCO MANUFACTURING COMPANY

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Houston, Texas LOS ANGELES 54, CALIF. Garland, Texas

LETTERS to the Editor

Damping Device for Camera Tracking Mount

I would appreciate it if you would tell me where I could obtain information on how to design a hydraulic type damping service to be used on a manually operated camera tracking mount. The speed of rotation is approximately 2 rpm and must be constant and smooth.

ALBERT MIGLIACCIO,
Head, Prototype Development Section,
U. S. Naval Ordnance Test Station

We do not know where you could get the exact design information that would enable you to build such a damping device. However, we assume from your question that hydraulic power is available. We suggest that the hydraulic damping device made by the Denison Engineering Company, 1166 Dublin Road, Columbus 16, Ohio be checked for its applicability to your problem.

Oil Filters with Replacement Signal

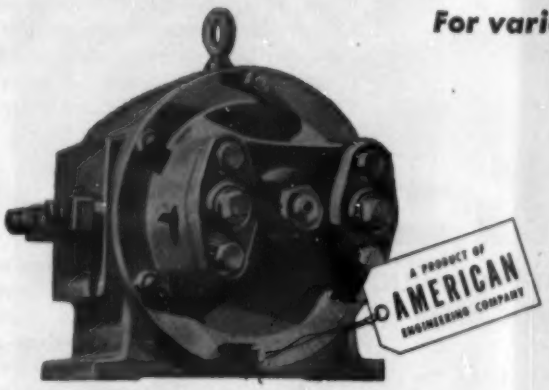
Can you tell us if there is an oil filter manufactured with a positive signal device or method to indicate that replacement or cleaning is required? We are looking for either a bypass or full flow filter with capacities up to 20 gpm, not motor driven units.

K. M. GEBEL,
Engineering Department
Landis Tool Company

We do not know of a commercially available signal device for oil filters. As you know, several bypass filters can be arranged with a pressure gauge to provide a visual indication of filter clogging. We assume that you are interested in an audible signal. We have seen signal devices in plants where they were

Continued on page 22

When it's high pressure... it's AMERICAN!



For variable pressures up to 3000 p.s.i. . . .

HELE-SHAW

THE FAMOUS HELE-SHAW is a radial-piston variable displacement fluid power generator. It is remarkably easy to apply to the machine it serves . . . may be installed on or near the machine, remote from it, or incorporated as an integral part of the design.

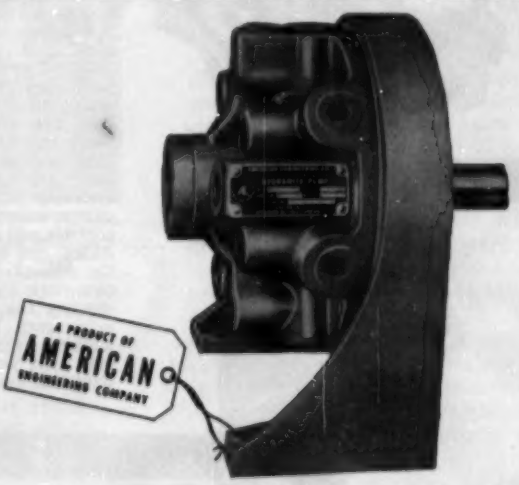
In the Hele-Shaw pump, pressure and reversal of flow are controlled directly at the pump. Discharge is infinitely variable from zero to maximum . . . and can be reversed instantaneously or gradually. Capacities range from 3¾ to 50 g.p.m. and upward.

For pressures up to 5000 p.s.i. . . .

HYDRAMITE

THE HYDRAMITE is a radically new radial-piston constant displacement fluid power generator . . . has an overall efficiency of 85% without supercharging. Direct-driven through a flexible coupling, Hydramite rotates in either direction . . . can be foot, flange or face mounted. It is available in 3, 5, and 10 g.p.m. oil capacities.

Products of American Engineering Company, the Hele-Shaw and Hydramite Pumps are outstanding in their respective high pressure ranges . . . bringing users top efficiency and economy on a vast and growing variety of hydraulically-operated equipment. Mail coupon for full information.



AE

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNA.

AE Products include: Hydramite and Hele-Shaw Fluid Power, Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Lo-Hed Hoists, Lo-Hed Car Pullers

American Engineering Company
2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: ☐ Kindly send me complete information about the new HYDRAMITE. ☐ Hele-Shaw.

Name_____ Title_____

Company_____

Address_____

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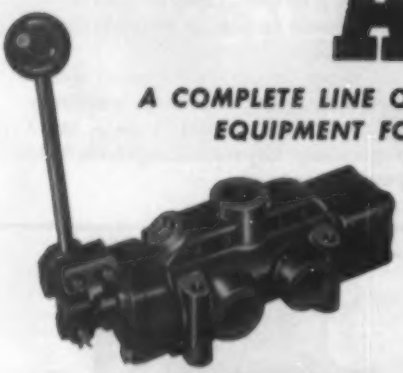
ADEL

A COMPLETE LINE OF INDUSTRIAL HYDRAULIC EQUIPMENT FOR EVERY APPLICATION



For fourteen years ADEL has continuously directed its energies to the advanced development and production of high-quality hydraulic equipment. With the most modern facilities in our 150,000 square foot plant, we build ruggedness, efficiency and compactness into each ADEL unit. The variety of equipment being manufactured has been steadily expanded until today it encompasses a complete line of hydraulic control valves, power pumps, solenoid operated remote controls and related equipment. ADEL can supply you with all the elements necessary to build complete hydraulic systems meeting the most exacting requirements. Make comparisons and see why more and more users, year after year, specify ADEL industrial hydraulic equipment.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

Write for Bulletins
ADEL DIVISION
OF GENERAL METALS
CORPORATION,
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Burbank, California

ADEL LEADER IN HYDRAULICS

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Manufacturers of Industrial Hydraulic Valves and Pumps

DISTRIBUTORS: AIR & HYDRAULIC CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAULIC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. F. SODERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • COBBY SUPPLY COMPANY, ST. LOUIS, MO. • INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO.,

Letters to the Editor

Continued

the brain child of a plant engineer. For example, Rockford Machine Tool uses a bypass filter with a gauge on which a red line indicates that the filter needs replacement. Other users have installed a small vacuum electric gauge in the suction line which gives an electrical signal that actually cuts out the relays of the driving motor when the suction filter chokes up to a point where pump starving is possible. Another plant uses a pressure switch which sets off an alarm bell to indicate that filter replacement is necessary.

Reinforced Nylon Tubing

Do you have any information as to a source of supply of fine wire spring reinforced, thin wall nylon tubing? This tubing is used as a protective boot on lead screws, shafting or hydraulic plungers to exclude dirt. These very thin tubes are compressible into very short spaces in proportion to their open and free length.

F. H. SUMPTION,
Engineer,
Whaley Engineering Corporation

We did some checking for a source of supply for fine wire spring reinforced thin wall nylon tubing and came up with one lead that may be useful to you. The Weatherhead Company, 300 East 131st St., Cleveland 8, Ohio, makes a special nylon tubing reinforced with stainless steel wire braid. We understand that this is made up in short lengths in both 5/8 and 1 inch sizes. Mr. Duane Burgeson of The Weatherhead Company can furnish you with additional details.

We are Sorry

Our attention has been drawn to a statement (page 34, your June, 1954 issue) that Vickers-Armstrongs Ltd., Elswick Works, are manufacturers of air bleeder valves. We would advise you that you are wrongly informed in this respect; while we manufacture hydraulic

Continued on page 26

JUST A twist OF THE wrist

That's all it takes to clean the Cuno AUTO-KLEAN—the strainer that can be continuously cleaned while it's working.

Turning the handle one revolution moves the strainer element through comb blades, removing all dirt from strainer surfaces. Dirt particles fall to bottom of housing, where they can be drained off periodically. Cuno's exclusive combing operation cleans thoroughly—without costly interruption of fluid flow.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass or stainless steel for long trouble-free service under any conditions.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 3,800 gallons per minute.

A.3.8

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

CUNO'S AUTO-KLEAN ENDS NEED FOR STAND-BY STRAINERS

Permanent strainer element saves on maintenance bills

You don't have to use a duplex strainer installation to get dirt and other solids out of your hydraulic fluids. A *single* Cuno AUTO-KLEAN strainer can do the job to your complete satisfaction.

This is possible because fluid flow doesn't have to stop while you're cleaning this strainer. Cuno's exclusive "comb-clean" action provides complete cleaning of the strainer element on the job—*without stopping fluid flow*. Thus, non-stop filtration, with no need for a stand-by strainer.

AUTO-KLEAN really cuts maintenance bills, for there aren't any cartridges to change. Occasional rotation of the handle does the cleaning job. (Most units can be equipped with motor drives for continuous cleaning.) If you want suction straining, AUTO-KLEAN is ideal. You can build it right into your sump, with the handle on the outside.

AUTO-KLEAN's low pressure drop gives full-flow filtration on gravity, low-pressure, high-pressure or suction lines—with no loss in operating efficiency. All solids larger than the specified disc spacing—from .0035" (170 mesh) to .062" (12 mesh)—are stopped by metal strainer discs. You can get standard AUTO-KLEAN filters built to operate at pressures up to 3000 psi.

Send the coupon today for free bulletin.

A.3.15

Cuno Engineering Corporation
Dept. 3515B South Vine St., Meriden, Conn.

Please send me free bulletin on Cuno AUTO-KLEAN strainers.

Name.....

Company.....

Address.....

City.....Zone....State.....

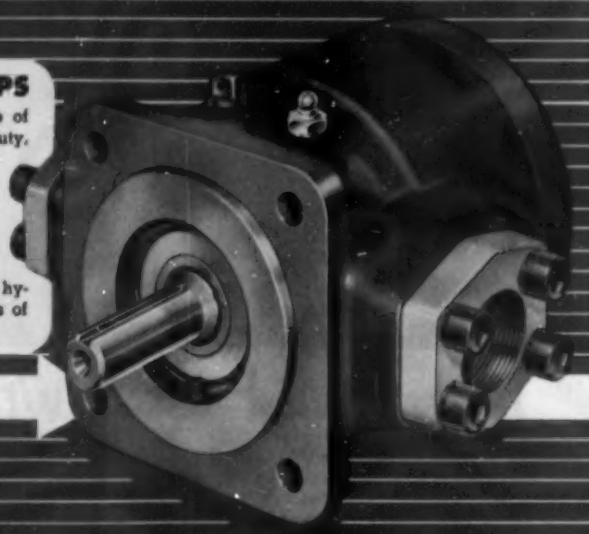
5000 PSI

FOUR COMPLETELY NEW LINES OF HYDRAULIC PUMPS WHICH GIVE YOU FAR MORE IN PERFORMANCE AT FAR LESS IN COST!

- Pumps to give new life to existing equipment . . . to improve performance, increase capacity!
- Pumps that afford the design engineer the basic equipment for entirely new concepts in hydraulically operated machines!
- Pumps for machines to do work better, quicker, cheaper!

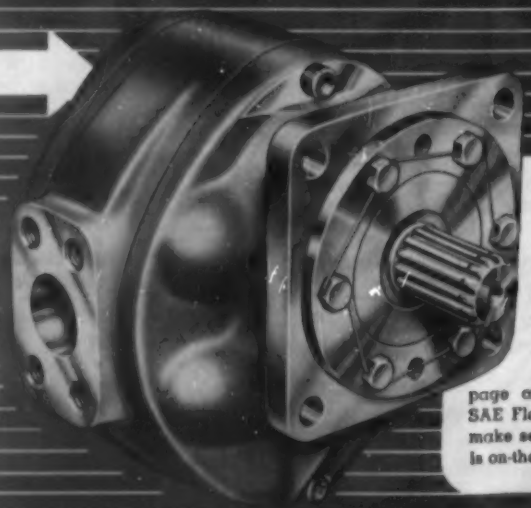
SERIES PF-100 VANE-TYPE PUMPS

DUDCO PF-100 Series Pumps can double the value of your *hydraulic dollar*. You get 2000 psi continuous duty, single-stage construction for the cost of equal capacity low pressure pumps . . . improved equipment design and increased machine efficiency without the payment of premium prices. These Pumps feature a simplified, 3-unit construction . . . the pumping cartridge incorporates the famous DUAL-VANE design which provides and assures complete balance of all hydraulic pressure loads. These Pumps have capacities of 3, 5, 8 and 11 gpm at 1200 rpm.



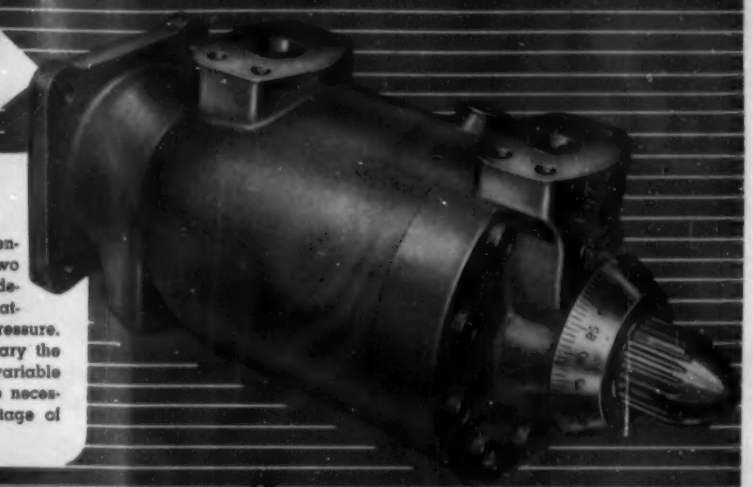
2000 PSI

1500 PSI



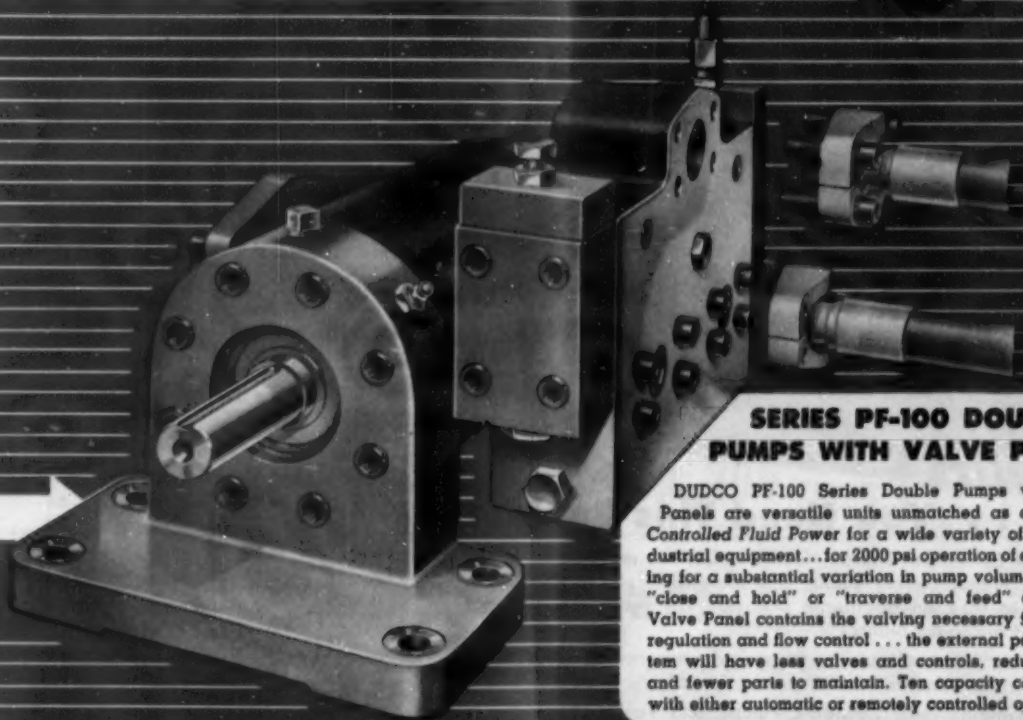
SERIES H GEAR-TYPE PUMPS

The HYDRECO Series H Pumps are intended for use in the hydraulic systems of heavy-duty mobile and industrial equipment, especially where shock loads, impact and rugged service are "normal working conditions". Four sizes (40, 50, 60, 70 gpm) deliver fluid power at 1500 psi . . . increased horsepower gives greater work output. *Pressure-Balanced* wear plates reduce oil slippage and eliminate power-robbing frictional contacts. SAE Flange Mounting and split-flange hose connections make servicing simple and reduce down-time. Equipment is on-the-job longer.



SERIES PV-600 PISTON-TYPE PUMPS

DUDCO PV-600 Series Variable Delivery Pumps generate continuous duty pressures up to 5000 psi. Two types of controls match pump output to system demands. A pressure-compensated regulator automatically varies the volume in response to system pressure. A hand wheel control enables an operator to vary the volume during the machine cycle. High pressure variable delivery means power is transmitted without the necessity for an accumulator and without any wastage of power thru a relief valve.



SERIES PF-100 DOUBLE PUMPS WITH VALVE PANELS

DUDCO PF-100 Series Double Pumps with Valve Panels are versatile units unmatched as a source of *Controlled Fluid Power* for a wide variety of modern industrial equipment... for 2000 psi operation of circuits calling for a substantial variation in pump volume as during "close and hold" or "traverse and feed" cycles. The Valve Panel contains the valving necessary for pressure regulation and flow control . . . the external part of a system will have less valves and controls, reduced piping and fewer parts to maintain. Ten capacity combinations with either automatic or remotely controlled operation.

THE NEW YORK AIR BRAKE COMPANY

1104 EAST 222nd STREET CLEVELAND 17 • OHIO

The New York Air Brake Company
1104 East 222nd Street
Cleveland 17, Ohio

Please send details on

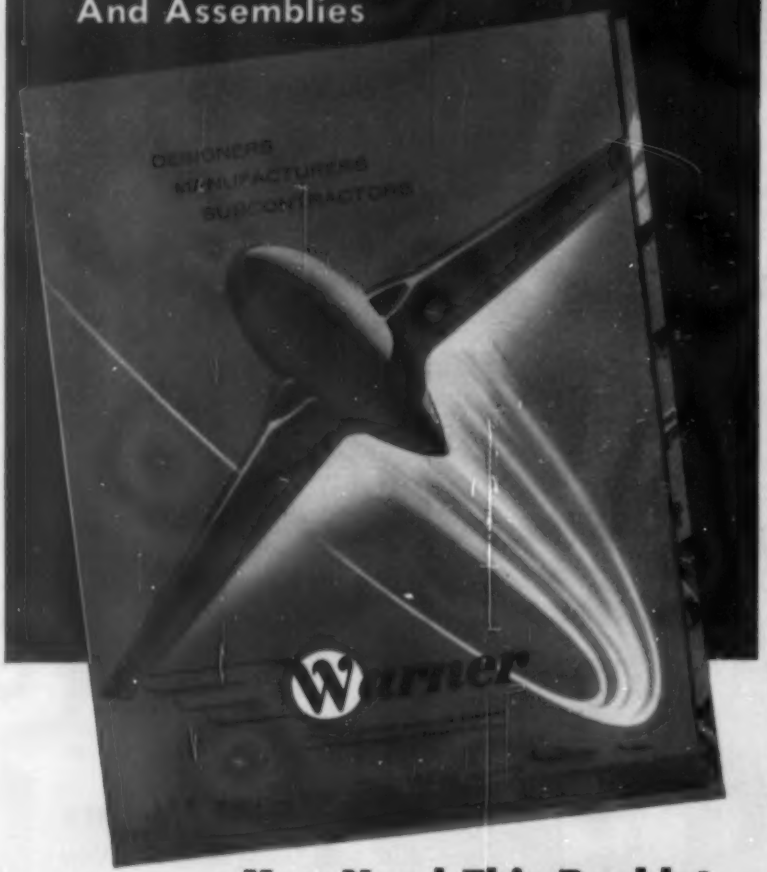
- ☐ SERIES PF-100 VANE-TYPE PUMPS
- ☐ SERIES H GEAR-TYPE PUMPS
- ☐ SERIES PF-100 DOUBLE PUMPS WITH VALVE PANELS
- ☐ SERIES PV-600 PISTON-TYPE PUMPS

Name_____

Address_____

City_____ Zone____ State_____

If You Are Looking For A Precision Subcontractor For Intricate Parts And Assemblies



. . . You Need This Booklet

The Warner Division of Detroit Harvester Co. has moved into a new and larger manufacturing plant. This expansion places Warner in a position to take on additional precision subcontracting work for aircraft and ordnance plants.

Capitalize on Warner's ability to manufacture to exacting tolerances. Consider Warner for the production of—

Landing Gear Cylinders, Pumps, and Valves
Hydraulic and Pneumatic Assemblies
Aircraft Fittings
Machining of Aircraft Forgings

Send today for your copy of the illustrated booklet shown above describing Warner's complete facilities. Warner engineers will welcome the opportunity to discuss your requirements with you.

Warner DIVISION OF DETROIT HARVESTER COMPANY

14300 TIREMAN AVENUE • DETROIT 28, MICHIGAN

DESIGNERS AND MANUFACTURERS OF HYDRAULIC PUMPS • VALVES • ACTUATORS

Warner Branch Offices

820 West Ave., Room 212, Norwalk, Connecticut
56 Canterbury Drive, Dayton 9, Ohio
2422 Forest Park Blvd., Fort Worth, Texas
7227 West 90th St., Los Angeles 45, California

Letters to the Editor

Continued

equipment, including the well-known "VSG" Hydraulic Transmission and various types of hydraulic control valves, this particular valve does not come within the range of our products.

R. ROWSON,
Manager
Hydraulic Engineering
Sales Dept.
Vickers-Armstrongs Ltd.

In running our statement to earth, we learned that the only justification for so stating this was that we published an article in our May, 1952 issue by J. E. Stringer and K. N. Hastings of your company, "Trapped Air in Hydraulic Systems" in which an air release valve was shown (page 112, Figure 4) and the following statement was made, "A number of manually operated air release valves have been developed at Elswick." The member of our staff who edited this article advises that on this basis the statement (page 34, June) was made. We are happy to acknowledge our error.

Pressure Switch for 5000 psi Service

I am looking for a pressure switch to operate in the range of 5000 psi, to be used on a series of hydraulic presses which we are building. Who makes hydraulic pressure switches with this capacity?

HARRY MORRISON,
Plant Engineer and
Purchasing Agent,
Jefferson-Travis, Inc.

We suggest that you get in touch with the Meletron Corporation, 950 North Higland Ave., Los Angeles 38, Calif. This company makes a very wide range of pressure switches and they could furnish a model that would come close, if not exactly, to your requirements.

Normally Closed Contact

I read with interest your article in the July issue of APPIED HYDRAULICS, titled "Control Circuits for Fluid Powered Work Transfers". It was very well presented. However, we seriously ques-

Continued on page 28

SAVE BY SWITCHING TO SUN HYDRAULIC OILS

If your system is in this condition	This is the Sun Oil recommended	And this is why
TIGHT SYSTEM. System never changed. Little or no make-up oil added.	**SUNVIS 900**	Exceptionally long life of Sunvis 900 keeps overall costs low.
TIGHT SYSTEM. Changed annually. Make-up oil added when needed.	**SOLNUS**	Solnus is a quality oil with a long life and a moderate price.
LEAKY SYSTEM without dilution. Where make-up averages 5% or more per month.	**SUNTAC**	Suntac cuts oil costs by reducing leakage an average of 35%.
LEAKY SYSTEM with dilution from water, cutting oil, emulsions and other liquids. Frequent change needed.	**CIRCO**	When frequently changed, Circo gives excellent protection at a low price.
DEPOSITS BUILT UP inside system from dust, sludge, varnish or other contaminants. Comparatively tight system.	**SUNVIS H.D. 700**	The cleansing action of Sunvis H.D. 700 removes deposits, eliminates costly tear-downs for cleaning.
DUAL PURPOSE. Machine tools designed so that hydraulic oil also lubricates ways.	**LUBEWAY**	A good hydraulic oil, Lubeway has the film strength needed to protect expensive ways.

No one oil can give greatest economy in *all* hydraulic systems. As this chart points out, the condition of the system must be considered. To make sure that the oil you select will give the maximum economy in your particular system, have a talk with your Sun Oil Company representative. Or write Department AH-10.

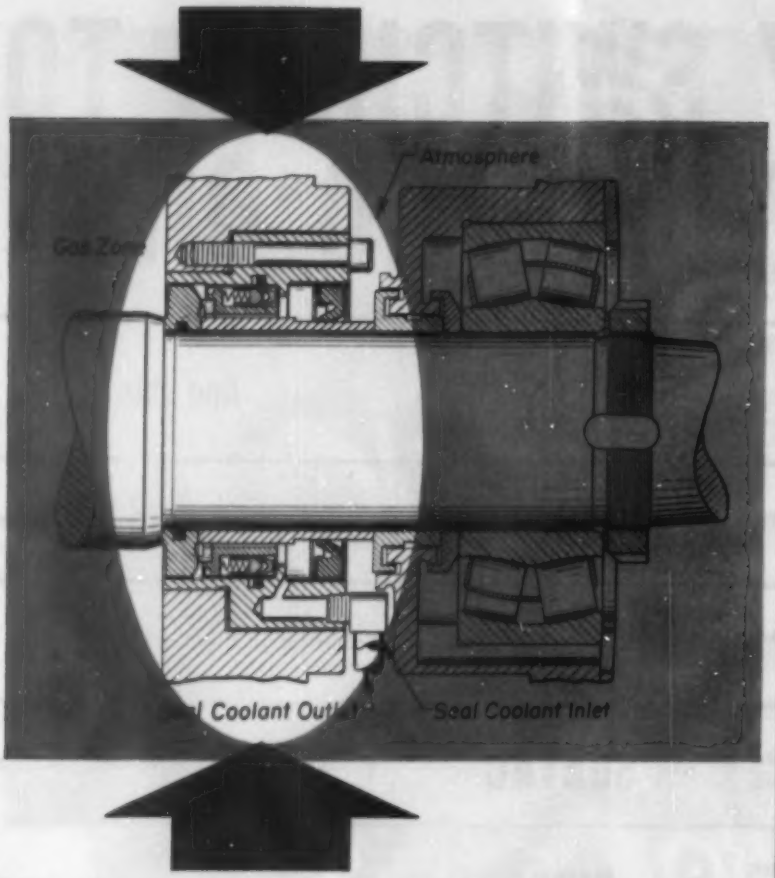
INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline



SEALOL SAVES SPACE

A big advantage of Sealol Balanced Pressure Shaft Seals is compactness. This seal, for a rotary compressor, is typical. The complete Sealol assembly takes up less axial and radial space than the anti-friction bearing beside it. By eliminating a deep, multiple-packing stuffing gland, the Sealol Seal permits locating the bearing closer to the load. The overall dimensions of shaft, housing, and assembled machine are reduced, and a time-honored nuisance—the stuffing box—has been completely eliminated.

Other success stories? Plenty of them! Sealol Seals are handling pressures to 1500 psi, rubbing speeds to 15,000 FPM, operating temperatures to 500° F. Our seal specialists have solved many difficult problems involving corrosive gases, hydrocarbon gases, high volatile fluids, and many other special conditions.

Consult Sealol on your shaft sealing problem. Ask for new Bulletin 7, or write us for specific data and recommendations. Sealol Corporation, 9 Willard Avenue, Providence 5, Rhode Island.

SEALOL

NEW YORK CITY • PHILADELPHIA
CHICAGO • CLEVELAND
HOUSTON • SAN FRANCISCO
LOS ANGELES • KANSAS CITY (MO.)
CHARLESTON (W. VA.) • ST. LOUIS
TULSA • EDMONTON — TORONTO, CAN.

THE BALANCED PRESSURE SEAL

Letters to the Editor

Continued

tion the location of the equalizing pressure regulator shown in Figure 2, and the normal open position of contact, CR2, in the CR1 relay circuit of Figure 3. We believe the pressure regulator should be shown in the line feeding the blank end of the piston and contact CR2 as normally closed, to enable the shuttle to function properly.

R. A. IGRAS,
Manufacturing Engineering Office
Production Offices
Ford Motor Company

Thank you Mr. Igras, for writing us concerning the article "Control Circuits for Fluid Powered Work Transfers". You are quite right in your two comments. In order for the forces on both sides of the transfer cylinder to be balanced, it is necessary to regulate the pressure on the head end at a lower value than the pressure at the rod end. Therefore, the pressure regulator should have been shown in the line to the blank end of the cylinder. Also, in order for the forward relay CR1 to operate when the retract relay is de-energized, contact CR2 should be normally closed. Thanks for pointing out these errors in the circuit drawings.

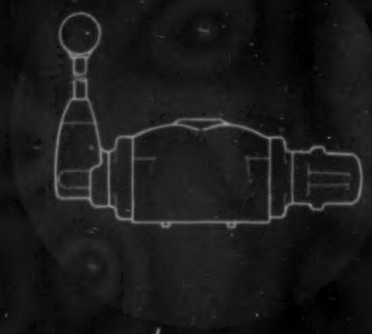
Modified Solenoid 4-way Air Valve

We would like to obtain a 4-way air valve with 3/8 inch pipe ports to be operated at pressures from 5 to 150 psi. This valve is to be both solenoid and manually operated. This means that this valve could be operated in one direction manually and then returned by the solenoid and suitable electric circuit. We would appreciate your advice on the source of a manufacturer of this type of valve.

JOHN DICKY,
Factory Engineering,
Columbus McKinnon Chain Corp.

We can offer a suggestion which came to us from a valve manufacturer's representative who has made successful applications of the arrangement you detail. This is to select a momentary contact, double

Continued on page 30



valves

pumps

RACINE

ALL COMPONENTS FOR ANY HYDRAULIC CIRCUIT

"They work better together"

boosters

WRITE FOR NEW CATALOG AND NAME OF NEAREST FIELD OFFICE

Complete Engineering Service Available without charge. Address:

RACINE HYDRAULICS & MACHINERY, INC.
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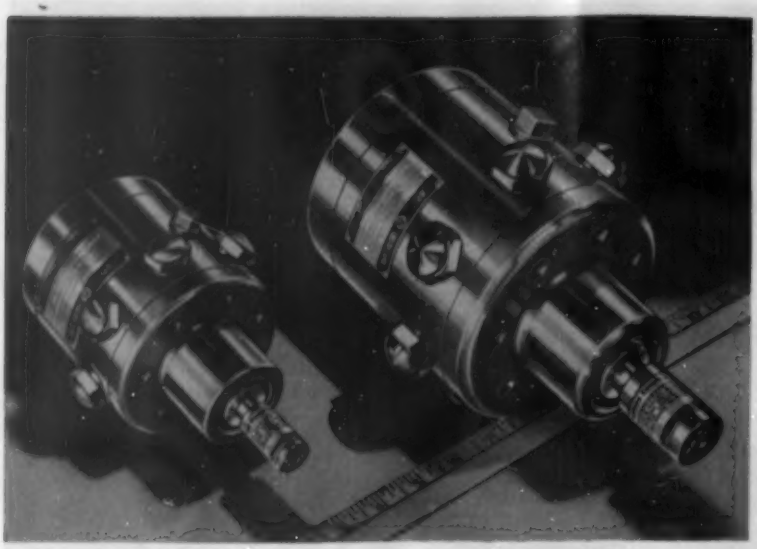
pumping units

RACINE HYDRAULICS & MACHINERY, INC. RACINE, WISCONSIN



LITTLE PUMPS WITH A Big Squeeze

SECO radial pumps generate pressure *within* HOLLOW PISTONS. The higher the pressure the tighter the seal. No loss of mechanical efficiency. The piston assembly is completely surrounded by pressure lubrication and literally floats in a hydrostatic film of oil during the pressure stroke.

For operations requiring extremely high pressure during some part of a cycle, a SECO Series LA pump will give you that "big squeeze" at a point where the muscles of a larger, big volume pump begin to "tire out."

Or, for applications where no large fluid volume is required, but where higher working pressure would *reduce the bulk of all components*, these pumps will deliver pressures up to 10,000 PSI—with no servicing problem worth considering.

If however, you use only pressures up to the widely accepted 5,000 PSI range, consider this: At such pressures SECO pumps merely loaf, so far as stress and wear are concerned.

These pumps are made in 5 models, delivering from ½ GPM to 5 GPM, and developing pressures of 3,000 PSI to 10,000 PSI. *Whether your interest is in higher pressures, or simply in longer pump life and freedom from servicing—Send for complete information.*

SIMPLEX ENGINEERING CO., ZANESVILLE, OHIO

SIMPLEX ENGINEERING CO.
Zanesville, Ohio

SECO

Please send complete information on SECO Series LA Pumps.

Name _____ Title _____

Company _____

Address _____

Letters to the Editor

Continued

solenoid 4-way valve, remove one solenoid and install a longer pin and a pushbutton for manual operation in one direction. Two or three of the leading manufacturers of air valves can furnish and modify this type of valve.

Air Turbines and Motors for Small Hand Tools

I am interested in obtaining information on the design and operation of air turbines and air motors of the type that are or could be used in small hand tools. Would you give us the name, author and publisher of any books or articles on these turbines and motors?

HARRY R. CARLSON,
Treasurer,
Rand Machine Products Corp.

We have referred your query to the chairman of the Technical Committee of the Compressed Air and Gas Institute through the Educational Director. We will publish his answer when the information is received. We asked that the information be sent to you.

New 1954 Data List

R. F. Corrigan, advertising manager, Pump Division, Geo. D. Roper Corporation, in response to a request from F. J. Fuchs of the North Carolina Works of Western Electric Company, answered in part: "in reply to your request for a good reference book on hydraulic design, our chief engineer suggests POSITIVE-DISPLACEMENT PUMPS AND FLUID MOTORS by Warren E. Wilson, published by Pitman Publishing Company. In addition, we suggest the Readers' Service Department of APPLIED HYDRAULICS; they may be able to suggest other publications that would be helpful in your work of designing hydraulic equipment."

Thank you, Mr. Corrigan. For all our readers' information, as well as that of Mr. Fuchs, the new 1954 APPLIED HYDRAULICS Data List, a bibliography of manuals, texts and leading manufacturers' technical literature, is in preparation and will be ready in late October.

on your Hydraulic Tubing problems

Need special service on a hydraulic tubing problem? Or special sizes and shapes made to your specifications? Then we're the people to see.

We're geared for service. Our research, production and sales teams are small enough to give you the kind of personalized service and teamwork that gets results when nothing else can. And they're big enough to achieve volume production in a hurry at our modern, versatile plant.

Whatever the type of cold drawn, seamless tubing you require, you'll find that Summerill is completely equipped to produce it to *your* specifications. What's more, every operation at Summerill is laboratory controlled to give you consistent peak quality of product with every tube.

Why not let us get started on your problem today? We'll welcome the opportunity to serve you and show you how you can make a better product at less cost with Summerill Seamless Tubing. Address: Summerill Tubing Div., Columbia Steel & Shafting Co., Pittsburgh 30, Pa.

Summerill

HYDRAULIC TUBING • SPECIAL TUBING • MECHANICAL TUBING • DIESEL TUBING • PRESSURE TUBING • AIRCRAFT TUBING

Announcing

new ASCO®
2-Way Solenoid Valve
for controlling the flow
of Air, Gas, Light Oil,
Water, Brine, Freon,
Methyl Chloride, etc.

BULLETIN 8210A
SOLENOID VALVE
shown approximate size

Pipe sizes—
3/8" and 1/2"

Maximum pressure—
Air—200 p. s. i.

Featuring:

- **Compactness** — 2¾" Face to Face.
  3¼" Pipe center line to top of Solenoid.
  3 13/16" Overall Height.
- **Simplicity** — Only two operating parts: flexible diaphragm and stainless steel core.
- **Ruggedness** — Designed for millions of maintenance free operations.
- **Forged Brass Body and Bonnet** insure freedom from porosity.
- **No Corrosion Problems** — All parts in contact with fluids are of brass or stainless steel.
- **Normally Open or Normally Closed** Types Available.
- **Low Power Consumption** — Only 10 Watts!
- **No Jamming or Binding** — No closely fitted parts that can be jammed by solid matter.
- **Nema I Standard or Nema VII** Explosion-Proof Solenoid enclosures.
- **Over Two Years** under Development and Life Test!

THIS NEW BULLETIN 8210A SOLENOID VALVE IS ONE OF THOUSANDS OF TYPES & SIZES IN OUR STANDARD LINE.

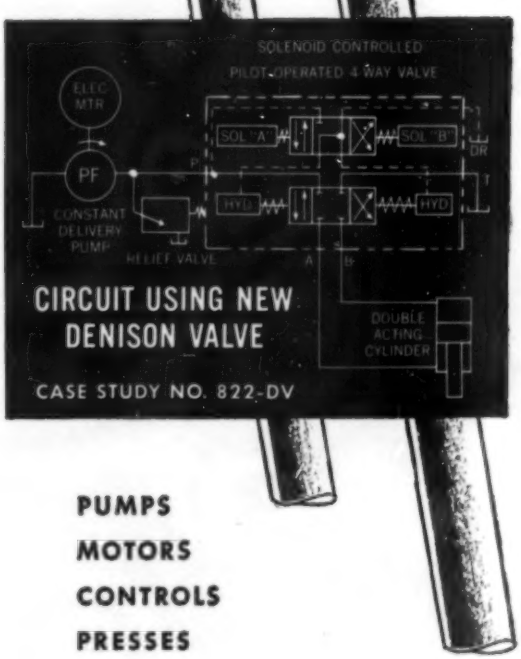
WRITE FOR COMPLETE INFORMATION
We design and manufacture a complete line of Solenoid Valves and Electromagnetic Controls including Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Complete Control Panels.

ASCO Solenoid VALVES

Automatic Switch Co.

385-H LAKESIDE AVENUE · ORANGE, NEW JERSEY

Millions of operations without measurable wear



NEW DENISON ¾" Solenoid Controlled—Pilot Operated Subplate Type 4-Way Valve for operating pressures up to 3000 psi

4 SPOOL TYPES—Provide all positioning arrangements required by most circuits.

SPOOLS POSITIONED 3 WAYS—With solenoid de-energized, spools may be spring offset, spring centered or without springs.

ADJUSTABLE PILOT CHOKES—Available if required for precise control of pilot flow to insure smooth, shockless reversal, time delay or sequence control.

PILOT PRESSURES TO 3000 PSI—Operated with pilot pressures from 50 psi to 3000 psi internally or externally without need for differential pistons.

INTERNAL OR EXTERNAL PILOT PRESSURE—May be internally or externally pilot operated and changed from one to the other in less than 2 minutes.

These SUPERIOR FEATURES in a valve likely INTERCHANGEABLE with that you are now using . . . but at a LOWER COST.

Inquire about quantity discounts.

GET FULL FACTS. Specifications and description are in Bulletins VD-7 and VD-8.

THE DENISON ENGINEERING COMPANY
1166 Dublin Road • Columbus 16, Ohio

PUMPS
MOTORS
CONTROLS
PRESSES

DENISON Hydr OIL ics
TRADE MARK

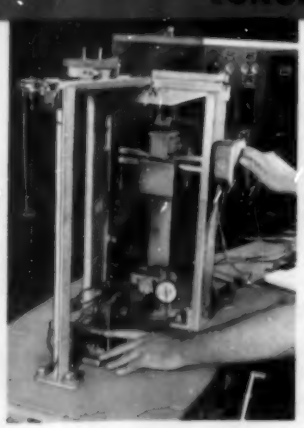
Circle 54 on Reader Service Card

For Insert Circle 76 →

GREATER FLEXIBILITY

New General Electric solenoids mount in five positions — end, right- or left-side, throat, or with thru-bolts. Both leads and built-in terminal board on strongbox coils give added flexibility.

LONGER LIFE



Laboratory tests proved the new strongbox solenoid has much longer life. Long life results from design features such as strongbox coil, and double-strength, spring-steel mounting brackets.

G. E. ANNOUNCES

NEW STRONGBOX SOLENOIDS

The all-new line of General Electric industrial solenoids was designed to include the features you requested. From your requirements, design specifications for the new line were written — and here is the new, more economical solenoid you asked for.

GREATER FLEXIBILITY

New solenoids mount in five positions. Mounting brackets can be moved to any of the four sides, or thru-bolts can be used. Both leads and built-in terminal board on strongbox coils make either type wiring immediately available.

LONGER LIFE

New General Electric solenoids last longer because of new design components. Strongbox coils, enclosed layer wound Formex* windings, give long electrical life. New double-strength, spring-steel mounting brackets contribute to added life. New design also includes glass fabric plunger guide, and larger linkage-pin hole.

COMPLETE RATING COVERAGE

Complete coverage is supplied by nine ratings in each of the following forms (nominal ratings at maximum stroke).

3.0 to 40 lbs in ½ inch pull forms
1.4 to 36 lbs in 1 inch pull forms
2.0 to 33 lbs in ½ inch push forms
4.3 to 28 lbs in 1 inch push forms

Sizes are available in 60, 50 and 25 cycle, and d-c forms. Voltage ratings are from 24 to 600 volts.

SMALLER SIZE

22 percent smaller for the same power ratings, new General Electric solenoids will reduce space problems when mounting solenoids in your equipment. Smaller enclosures and reduced material costs make new solenoids more economical.

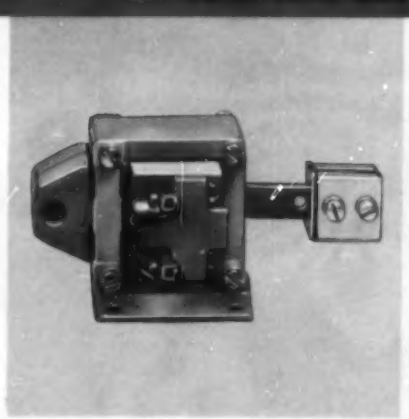
FOR MORE INFORMATION contact your nearest Apparatus Sales Office, or Distributor, or write Section 730-58, General Electric Company, Schenectady 5, N. Y. Ask for Bulletin GEA-6215.

*Reg. Trademark. General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

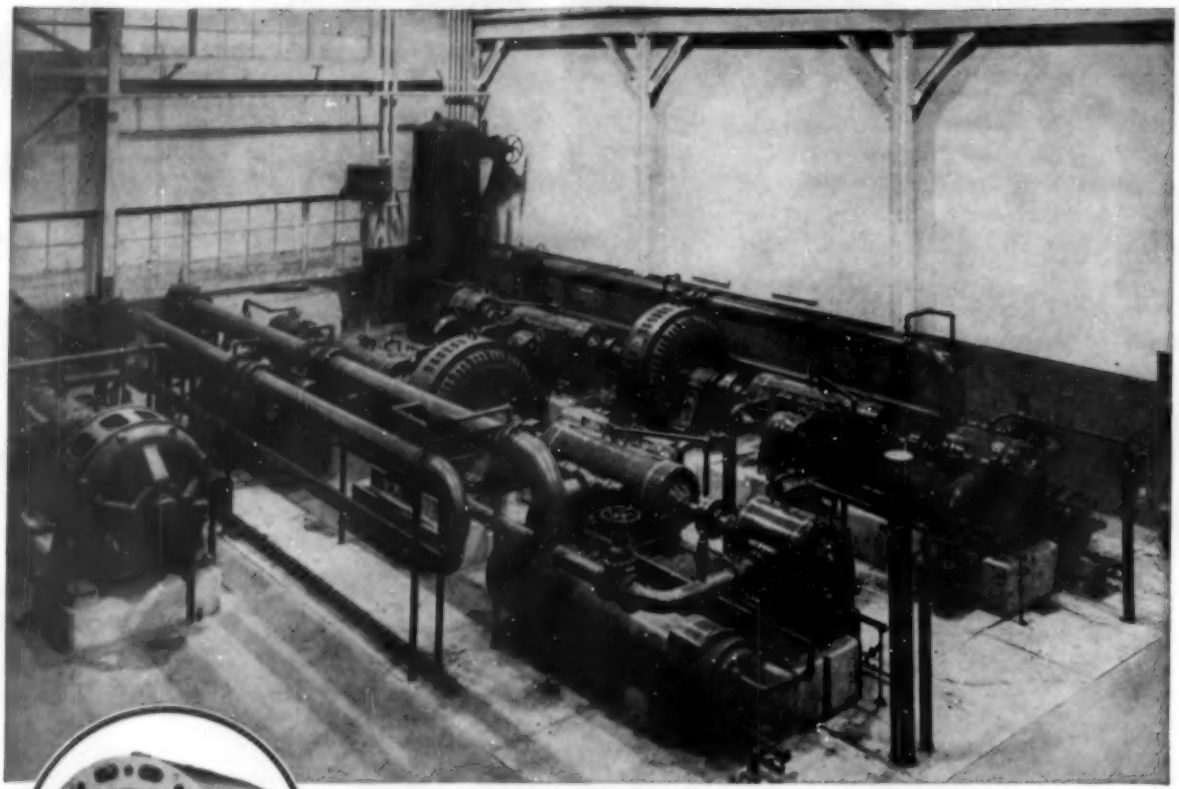
COMPLETE RATING COVERAGE

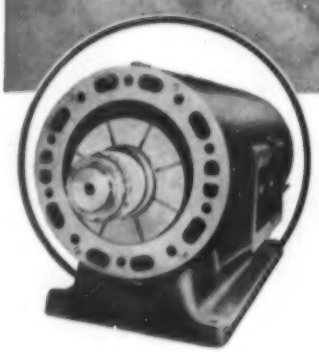


Supplied by nine force ratings in each of the forms, new strongbox solenoids are available in both push and pull forms, at one-half and one inch strokes. All these sizes are available in d-c, 25, 50, and 60 cycle a-c, with voltage ratings from 24 to 600 volts.

SMALLER SIZE

22% smaller for the same power ratings, new General Electric solenoids will reduce space problems in your equipment.





Fuller Rotary Two-stage Compressors supply plant air at 100-lb. at Western Electric

Day in and day out, long periods of continous operation don't overtax these Fuller Rotary Compressors at Western Electric Company plant at Indianapolis, Indiana. The installation comprises two two-stage duplex units, with a capacity of 3300 c.f.m. each, and one two-stage single unit, capacity 1665 c.f.m.; supplying all plant needs at 100-lb. pressure.

Endurance, plus efficiency and maintained capacity, flow of air without pulsations, elimination of vibration, are results of the rotary principle employed in the design of the Fuller Compressor. They employ a minimum of moving parts-rotor, bearings, blades, greatly reducing maintenance and eliminating adjustments entirely.

In addition, Fuller Compressors do not require auxilliary speed-change gearing—they are designed to operate at common electric-motor and internal-combustion engine speeds, except when turbine driven.

You'll find, as many others have, that Fullers stay on the job with a minimum of attention and maintenance. If your plant requires air in volume, it will pay you to investigate these modern, low-operating cost machines. A Fuller engineer will be glad to discuss your air requirements with you.

FULLER COMPANY—CATASAUQUA, PA.

Chicago • San Francisco • Los Angeles • Seattle • Birmingham

G-299
9724

Fuller *Pioneers of high-efficiency rotary compressors*

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS • COMPRESSORS & VACUUM PUMPS • PREHEATERS • FEEDERS AND ASSOCIATED EQUIPMENT

Simplify Your... HYDRAULIC TUBING CONNECTION WORK

...with these IMPERIAL PRODUCTS

With Imperial Fittings and Imperial Tubing Tools, you have a really great combination for making joints that are absolutely leakproof even under severe conditions of pressure, temperature and vibration.

IMPERIAL TUBING TOOLS
get better jobs done faster

HI-DUTY TUBE CUTTER

Has ball bearing action, flare cut-off groove in rollers. Retractable reamer. **No. 274-F** for ⅛" to 1" O.D. Tubing. **No. 312-F** for ¼" to 1⅜" O.D. **No. 206-F** for ¾" to 2¼" O.D. Also Sawing Vises.

37° FLARING TOOLS

that quickly make J.I.C. flares in the field equal to production flares. Easy single lever clamping. **No. 437-F** flares 6 sizes, 3/16" to ⅜" O.D. Tubing.

Following tools are ROL-AIR type which make extra strength flares with burnished face:

No. 400-F flares 6 sizes, 3/16" to ⅜" O.D. **No. 537-F** flares ¾", ⅞", 1" and 1¼" O.D. **No. 637-F** flares 1½", 1¾" and 2" O.D.

LEVER TYPE BENDERS

New "Blue Dot" models bend hard and soft tubing including J.I.C. steel. **No. 364-FH** Individual Benders for each size of tubing 3/16" to ¾" O.D. Also GEAR TYPE BENDERS, **No. 270-F** for all tubing, including hard temper, heavy wall steel. Individual benders, sizes ⅜" to 1⅛" O.D.

Ask for Bulletin Set HC

IMPERIAL *Steel* 37 FLARED TUBE FITTINGS

Sleeve reduces wrench torque required in tightening. Permits bends close to joint. Strengthens joint.

★ This 3-piece flare fitting is easy to install — even in close quarters. Made to the rigid standards of quality for which IMPERIAL is famous. All male pipe thread ends protected by plastic caps.

★ Joints stay fluid-tight beyond burst pressure of the tubing. Meets J.I.C. and S.A.E. requirements as well as specifications of the A.S.M.E. Code for Pressure Piping.

★ Used with J.I.C. and other soft steel tubing. IMPERIAL 37° Flare Fittings also furnished in brass and stainless steel for use with copper, fully annealed stainless steel tubing, etc.

IMPERIAL *Steel* ERMETO TUBE FITTINGS

NO FLARING . . . NO THREADING . . .
NO WELDING . . . NO SOLDERING

Fitting consists of 3 pieces: body, nut and sleeve. When assembled, sleeve bites into tubing assuring a tight joint.

★ Make safe connections that withstand high pressures and vibration. Joints stay fluid-tight beyond burst pressure of the tubing itself. Meet J.I.C. requirements.

★ Easier and faster to install. Only an open wrench needed. All male pipe thread ends protected with plastic caps.

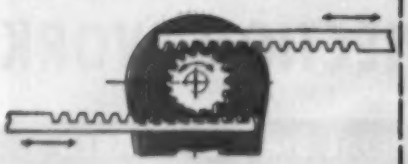
★ Can be used with practically any tubing, including heavy wall tubing that is difficult to flare.

See Your Imperial Distributor

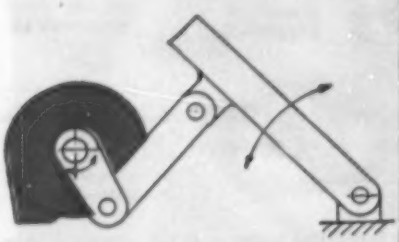
THE IMPERIAL BRASS MANUFACTURING CO.
1242 W. Harrison St. Chicago 7, Ill.
In Canada: 334 Lauder Ave., Toronto, Ontario

IMPERIAL

Pioneers in Tube Fittings and Tubing Tools

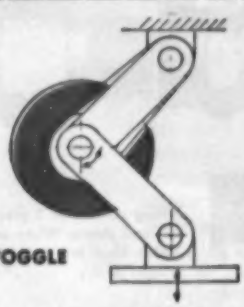


STRAIGHT LINE MOTION
DOUBLE TRAVEL



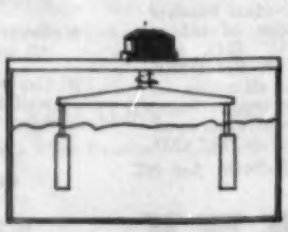
LIFTING

FIXTURE
POSITIONING
OR
INDEXING

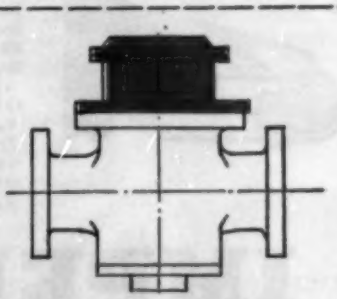


TOGGLE

HIGH TORQUE RATCHET DRIVE



MIXING OR AGITATION
(OSCILLATING ACTION)



VALVE TURNING

you can perform ALL these operations smoothly, positively, efficiently, with the space and weight saving

Hydromotor

Completely sealed and self-contained, the Hydromotor is a simple, dependable, maintenance-free source of *reciprocating rotary power*, installable anywhere . . . at any angle.

Using any hydraulic medium, the Hydromotor develops instant, full torque in either direction through any arc up to 280° . . . may be stopped at any point, reversed, speeded up or slowed down by simple controls. Standard models develop 150 to 300,000 inch pounds torque at 1,000 p.s.i. input. Two vane models, same size, afford double torque values through arcs to 100° —all based on 1,000 p.s.i. oil supply.

For complete application and engineering data, write for Hydromotor Bulletin 21, or outline your requirements.

Hydromotor DIVISION

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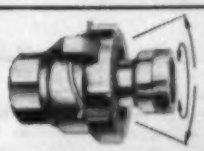
The Only Complete Line of

BALL • REVOLVING
SWIVEL • SWING

JOINTS

WHEREVER PIPING CONNECTIONS MUST MOVE, look to BARCO for the ANSWER! Whatever your problem, Barco, invariably, can solve it BETTER, EASIER, and QUICKER with a tested and proven joint right out of the standard Barco line. This is because Barco builds a truly complete line of flexible ball, swivel, swing, and revolving joints — *there is a size and type for every purpose!* Submit your problem; ask for recommendations — Barco is at your service.



Flexible

BALL JOINTS

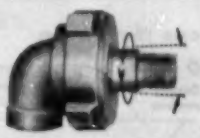
for Angular Flexing and Swivel or Twisting Movement

This is a versatile, general purpose design suitable for many applications. Standard the world over where low cost, leakproof, movable joints are needed in piping handling steam, air, water, oil, gas, or chemicals. One joint will frequently serve the same purpose as several one-plane swing joints. Up to 40° side flexibility *plus* 360° swivel action facilitates quick connection of piping, overcomes misalignment. Pressures to 7,500 psi; temperatures to 1,000° F. 12 styles, sizes from ¼" to 12".

Self-Aligning

SWIVEL JOINTS

for Swivel Motion or Slow Rotation



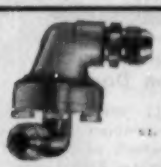
Specially designed for and widely used in making compact, low torque connections to reciprocating or hinged parts on molding presses, construction machinery, die casting machines, oil burners. Barco's *self-aligning* feature provides side-flexibility (up to 10°) which speeds up installation and prevents binding. Easy to position piping accurately—no sagging, flopping lines. Leakproof, pressure safe. Ratings as high as 600° F., 3,000 psi (hydraulic). Sizes, ⅜" to 2"; angle or straight.

Leakproof

REVOLVING JOINTS

for Continuous Rotation

Barco design insures trouble-free performance, minimum roll drag, and up to 50% power savings. Inherent low torque is little affected by increasing pressure, speed, or temperature. Parts are easily accessible. Light running action minimizes wear, permits free-floating installations. No adjusting necessary — long, leakproof service. Ratings to 250 psi (steam); 450° F. Single flow or syphon styles. Sizes ½" to 2" and special to 5". Wide choice of styles.

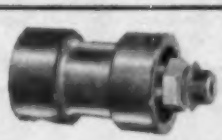


High Pressure Hydraulic

SWIVEL JOINTS

for Aircraft, Ordnance, and Industrial Service

Especially designed for high pressure hydraulic or pneumatic use with flared tubing or small piping. Flexibility in joint absorbs vibration, compensates for misalignment, eliminates binding, minimizes wear, simplifies and speeds up installation. Choice of styles; sizes ¼", ⅜", ½", ⅝". Corrosive resistant construction for service to 3,000 psi, −100° F. to 500° F. Approved for many military and aircraft applications.

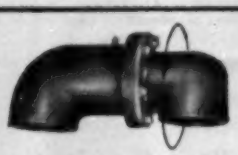


High Speed

REVOLVING JOINTS

for Clutches, Chucks and Machine Tools

¼" Type NV. Used in making high speed, leakproof rotary connections for pneumatic, hydraulic, or coolant lines. Light running, sealed ball bearing design handles both radial and end thrust with low torque and minimum wear. Easy to install where space is limited; economical. Precision built for rugged service. For speeds to 2500 RPM; pressures to 300 psi (air) or 1500 psi (hydraulic).



"Controlled Torque"

SWING JOINTS

for Loading Racks, Fueling Assemblies

Built to support piping and provide for swing movement in handling gasoline, oil, alcohol, and other fluids. Special ball bearing, long sleeve design with exclusive "controlled torque" action permits uniform, easy movement, but prevents annoying uncontrolled swinging. Single swing, double swing, and counterbalance styles with counterweights to meet every need. In steel and malleable iron, sizes 2", 2½", 3", 4". Also in complete loading line assemblies.

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- ☐ SWIVEL JOINTS (Tubing Type) Catalog 269.
- ☐ REVOLVING JOINTS. Catalog 300A.
- ☐ TYPE NV REVOLVING JOINTS. Catalog 307.
- ☐ SWING JOINTS. Catalog 400.
- ☐ INSULATING (Electrolytic) JOINTS for Piping.
- ☐ FLEXIBLE STRUT JOINTS for structural uses.

The Fall Wiper Ring

Keeps The Piston Rod Clean!

Since 1944—Spring-Loaded with "Squeeze Grip Action" and (dry) Lapped True Circle

Used During World War II and ever since by the Military

FALL WIPER RINGS Spec. MIL-S-5049 are AN Approved. (Our P/N-FWR-3C.)

Squeeze Grip Action Does It

The 3-piece FALL WIPER RING (our P/N FWR-3C) assembled into one piece as covered by patents consists of (1) a one-piece Split Wiper Ring (body) with two flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in the groove (3) an endless cover band surrounding the spring in the groove which causes a squeeze grip action on the piston rod.

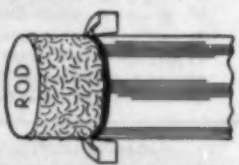
The FALL WIPER RING is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.

Exclusive Spring-Loaded "Squeeze Grip Action"—

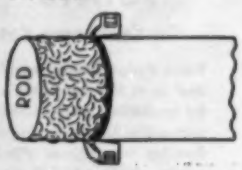
1. Eliminates spotty or erratic contact on rod.
2. Provides longer life because the spring in the "Squeeze Grip" takes up all wear, while the light-tight wiping edge continues to grip the rod.
3. The Spring Loaded "Squeeze Grip" Action on the rod is exactly the same for any number of rings of a given size because the pounds of ***breakout friction*** is individually controlled in each ring.

Exclusive Factory Lapped (dry) by Pre-Actuating

In addition to complying with Spec. MIL-S-5049, we create a ***worn-in*** true circle contact on piston by carefully pre-actuating each ring. This is done to avoid a wearing-in period after the ring has been installed . . . a period during which the ring might not completely contact the piston with the possibility that small metal fragments would wear off and enter the packing gland. This pre-actuating process is used by us exclusively and insures **immediate true circle contact,** from moment of installation. Only when the Spring Loaded "Squeeze Grip" action and Factory Lapped (dry) features are combined can full wiper contact and a light-tight wiping edge be assured. (See illustration above, right.) This full wiper contact is long-lived because the spring in the "Squeeze Grip" action takes up the wear while the light-tight edge continues to grip the rod.



NOT FACTORY LAPPED (DRY) - LEAVES DIRT ON ROD



FACTORY LAPPED (DRY) WITH "SQUEEZE GRIP" ACTION ON ROD—STOPS PASSAGE OF DIRT (except at Joint)

OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

User Satisfaction—
The FALL WIPER RING with CLOSED JOINT (our P/N-FWR-CJ)

Another First for FALL WIPER RINGS . . . the 3-piece FALL WIPER RING assembled into one piece—with CLOSED JOINT "CJ" has been especially designed for those applications requiring absolute freedom from dust and dirt passing through joint of ring to bearings or packing in dry operations. (See illustrations at left). This FALL WIPER RING with CLOSED JOINT has the same Spring Loaded "Squeeze Grip" Action—wiping edge contact on rod as (Our P/N FWR-3C) and functions exactly the same BUT with the added assurance that NO dirt or dust passes through the Joint. Patented and other patents pending.

FALL WIPER RINGS with CLOSED JOINT (our P/N FWR-CJ) can be adapted to countless industrial applications and are available in most popular sizes. Our Engineering staff would be pleased to work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Company

P.O. Box 784 Toledo 1, Ohio Phone ADams 6513

You Can Depend on ACE PRODUCTS . . . *Established 1935!*

All Fall Wiper Rings are covered by patents issued and patents pending.

Fall Wiper Ring SPRING LOADED

Startling Facts

ABOUT MOTOR BEARING LUBRICATION

FREE!.....THIS FULL-COLOR PROFUSELY ILLUSTRATED BOOKLET OF FACTS THAT HAVE A BEARING ON THE LIFE OF YOUR MOTORS

Comparisons of methods for lubricating electric motors are interestingly depicted in this new booklet. It illustrates the three principal types of bearing systems used in motors—cartridge, one-side lubrication and Lubriflush—with explanations of the functions of each. For demonstrating the action of re-lubrication in the U. S. Lubriflush bearings, a transparent bearing housing is dramatically illustrated by a series of natural color photos. Proof that any motor bearing breathes air and therefore leads to contamination of the bearing is photographically demonstrated to indicate the necessity of lubrication every year or so. Excerpts of statements by leading bearing manufacturers about the necessity of motor lubrication are presented. This informative educational booklet, edited by lubrication engineers, is full of startling facts you should know. Write today for a complimentary copy. Simply fill in the Coupon below.

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Here's the successor to pipe threads.

Pat. No. 2,681,817

Now you can forget these common hydraulic connection faults:

- Difficult assembly in close quarters
- Angle connection difficulties
- Separate unions and swivel joints
- Distortion and wedging from pipe threads
- Spiral leaks
- Blowoffs

Anchor Ductile-Sleeve Hose Assemblies

Here's top protection against costly hydraulic leaks and blowoffs in many types of high-pressure service. Anchor's Ductile-Sleeve Assembly is factory assembled to your specifications — you get exactly what you need to reduce your assembly costs on the line.

You get an exclusive grip — the patented ductile sleeve deforms in the swaging operation to make the coupling virtually part of the hose reinforcing wire. That's why it can't leak, can't blow off — even under extreme pressure.

Circle 16 on Reader Service Card

. and all their problems — the new

ANCHOR
FLANCO (Reg. U. S. Pat. Off.)

4-Bolt, Split-Flange Couplings

Say goodbye to pipe thread nuisance with Anchor's new FLANCO Coupling. It's the only SAE-approved high-pressure assembly to give you all these advantages:

Leakproof. "O" ring principle provides a permanently secure, leakproof seal without gaskets, sealing compound or tapered threads. The greater the pressure — the tighter the seal.

Can't tilt or blow off. Patented design prevents clamp-half from tilting and extrusion of the "O" ring. Malleable-iron clamp-halves withstand the burst pressure of high-pressure hose without blowing off.

Easily assembled. No cumbersome pipe wrench required — assembled easily and quickly with a small automotive-type wrench. Ideal for confined spaces. Reusable over and over again.

Keeps equipment operating longer. No tapered threads to wedge or cause troublesome distortion in cylinders, valve bodies, pump housings, etc.

Eliminates separate unions and swivel joints. Now you can make union connections at one or both hose ends. And you can use short, stiff lengths of hose because you needn't deflect the hose assembly to make up the joint.

There's an Anchor FLANCO coupling for your job. Look at this range of sizes and types.

Pressed-on Coupling gives you streamlined, safe, low-cost connection. Made to manufacturer's specifications and available only in factory-applied hose assemblies, pressed-on units are ideal for production-line work — no expensive cutting or fitting on the job. Coupling swaged to hose with special machinery — you get a permanent, leakproof assembly. Available all sizes ½" I.D. to 2" I.D.

Clamp-type Coupling gives you fast, easy hose-replacement — minimum downtime for repairs. Only tools needed to make secure assembly are two automotive-type wrenches and a vise. Clamp-type couplings in stock for ¼" to 2" I.D. high-pressure hose and ½" to 2" I.D. low-pressure hose. Seven different stems available to make neat angle connection: straight, 22½°, 30°, 45°, 60°, 67½°, 90°.

New!

Two Anchor hose assemblies for specialized industry use

New!

Power-steering hose assemblies

are designed to manufacturers' exact specifications. Special high-expansion hose eliminates noise. Step-down coupling design breaks up resonant vibrations from pump to steering assembly. Anchor assemblies provide quiet, long-life power steering operation without pulsation for automobiles, trucks, off-the-road equipment, farm tractors, industrial lift trucks and similar applications.

New!

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is especially designed to give extra life, extra dependability. Factory-applied, swaged-on couplings won't leak, can't blow off. Ideal for automotive air-conditioning units as well as stationary and industrial equipment. Available with male-to-male, male-to-female, and female-to-female connections — in diameters and lengths to meet manufacturers' specifications.

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1

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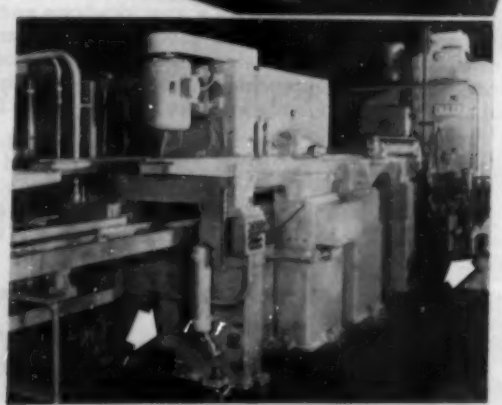
BRING YOUR FILTER PROBLEMS TO BRIGGS . . . Consult the yellow section of your telephone directory for your Nearest Briggs Representative.



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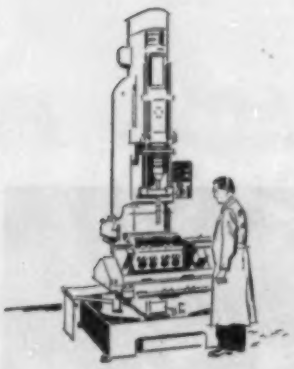
THE BRIGGS FILTRATION COMPANY, WASHINGTON 16, D. C.



"Power flow smoothed... reject problem solved"

A large Eastern manufacturer of pressed metal specialties was faced with the problem of erratic operation of the hydraulic presses... *resulting in a high percentage of rejected pieces.* Sinclair Lubrication Engineer Don Rigg was asked for his recommendation.

Vanes and valves coated

Mr. Rigg reports, "While examining the pumps, I found indications of lacquer deposits on the vanes and flow control valves *which interfered with the steady flow of power.* I recommended one of Sinclair's newly developed DURO Hydraulic Oils. This specially formulated oil offers additional protection against the formation of sludge and lacquers – permits smooth, positive transmission of power.

Test convinces customers

Mr. Rigg continues, "The customer introduced Sinclair DURO into several presses. After a trial period in which *outstanding results* were noted, the company decided to standardize on Sinclair DURO as their hydraulic medium."

Why not give a Sinclair Lubrication Engineer the chance to help solve your lubrication problem. *There's no obligation.* Contact your local Sinclair office or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N.Y.

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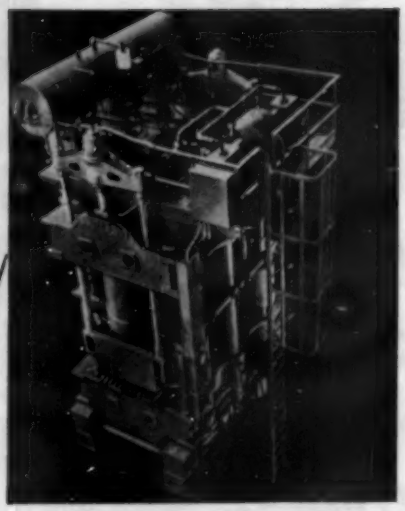
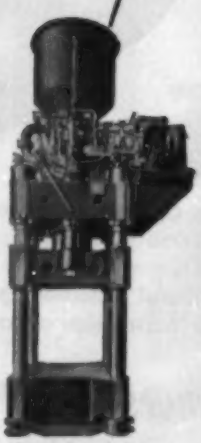
ROBERTSON EXTRUSION PRESS.

All over N.America you will find
ELECTRAULIC HIGH SPEED PUMPS
AND AUTODRAULIC CONTROL VALVES



BIRDSBORO PRESS PRODUCING CORRUGATED ROOFING.

LOGAN INJECTION MOULDING PRESS.



PULP BALING PRESS

All over North America Electraulic All-Hydraulic high speed pumps and Autodraulic control valves are giving consistent and unfailing performance over a wide range of applications. A direct hydraulic system powered by Electraulic pumps and operated by an Autodraulic control system (no solenoids) is an independent unit, unaffected by the demands of other machines, giving any desired pressure at fingertip control—it cannot fail to give increased efficiency and economy in your plant.

ELECTRAULIC
HIGH SPEED PUMPS

DIRECT HYDRAULIC SYSTEM
TOWLER BROS (PATENTS) LTD. RODLEY. NR. LEEDS. ENGLAND.
Sole Agents U.S.A. and Canada
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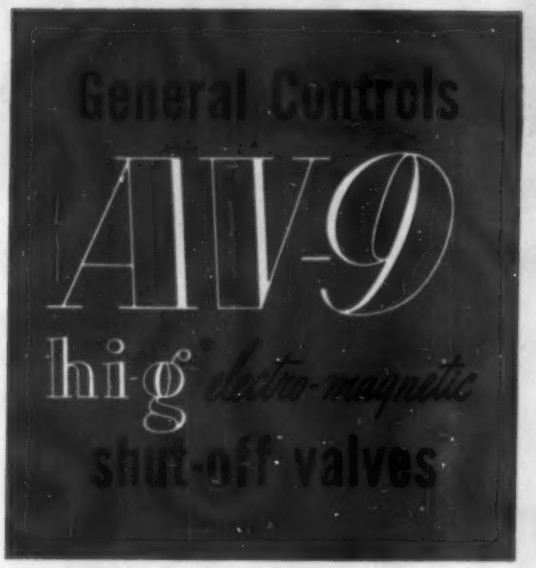
DEPENDABLE... for hi-pressure for hi-flow capacity for hi-g resistance



General Controls AV-9 hi-g® electro-magnetic shut-off valves provide high-pressure and high-flow capacity with distinct savings in size and weight. The pilot-valve construction minimizes current consumption and provides additional work force for controlling all liquids and gases, including hot air. Many variations of this versatile valve can be built to order. For high pressure control, high-flow capacity and reliable performance under high "G" conditions, General Controls' AV-9 is a *super* valve. Write for Catalog 53-A on your company letterhead.

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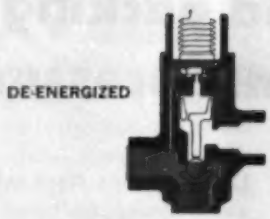
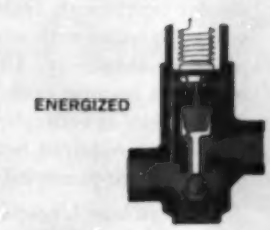
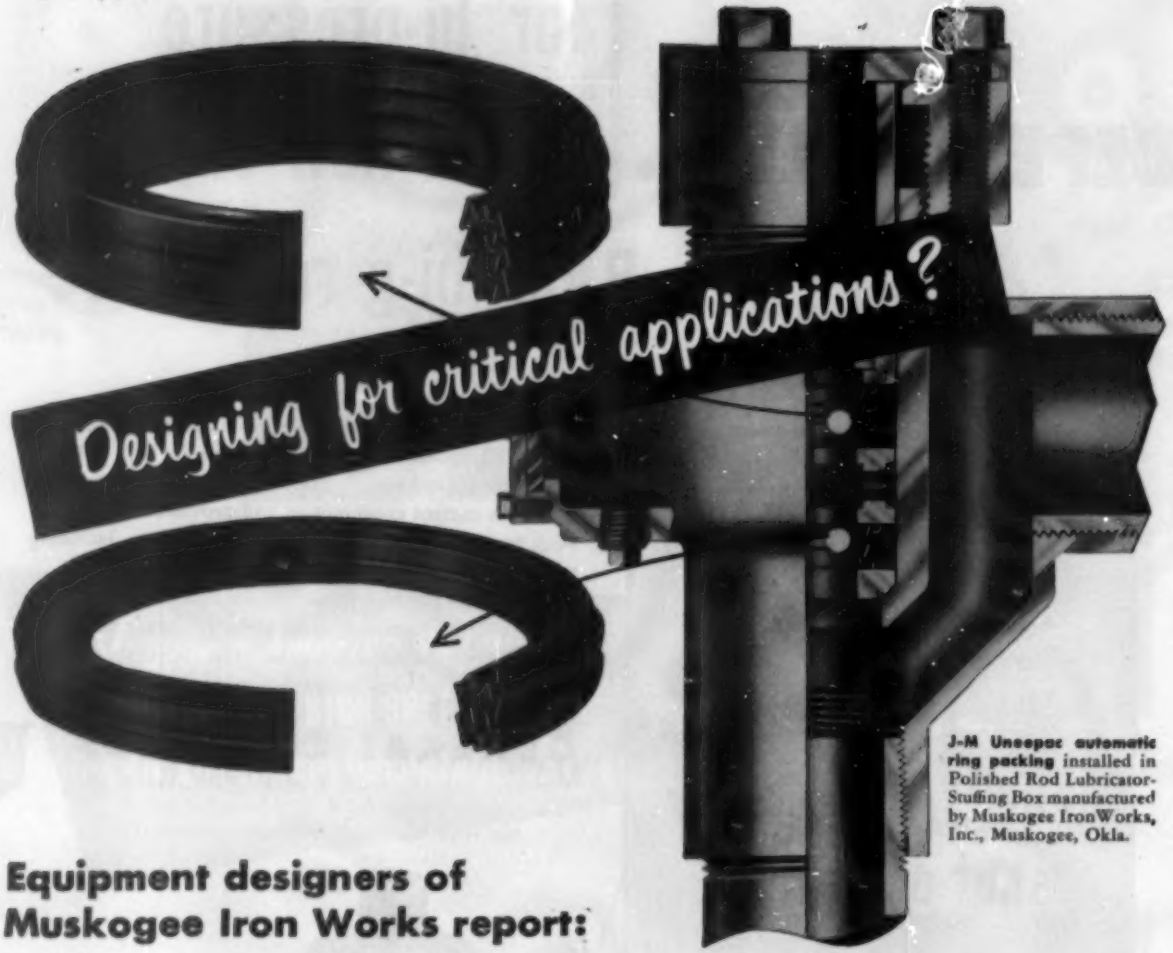
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY





Type shown is normally-closed when de-energized; normally-open types also available.

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.



J-M Uneepac automatic ring packing installed in Polished Rod Lubricator-Stuffing Box manufactured by Muskogee IronWorks, Inc., Muskogee, Okla.

Equipment designers of Muskogee Iron Works report:

"Greatly increased packing life . . . Uneepac guards against pressure damage"

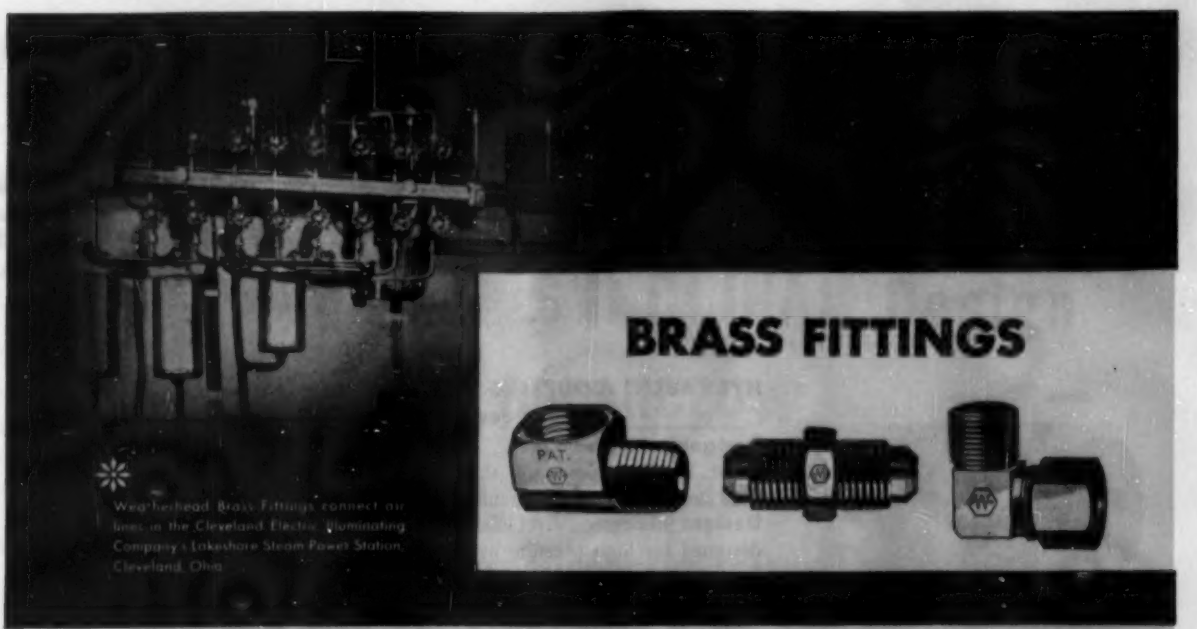
FOR THEIR NEW LUBRICATOR-STUFFING BOXES, design engineers of Muskogee Iron Works needed a packing with long service life as well as foolproof operation. Uneepac, the Johns-Manville automatic ring packing, fully met both of these requirements and contributed to the success and acceptance which the equipment has encountered.

In this application, Uneepac protects itself against damage by excessive gland pressure. The lips of each ring are guarded by the projecting portion of the Uneepac Center section. As a result, far greater service life and reliability is obtainable in this application than with other types of packings.

Uneepac offers many other important advantages for use in pump rods and plungers, compressors and similar equipment. Seals effectively in a minimum of space. Operates with minimum friction. Has excellent pressure sensitivity. Uneepac provides trouble-free operation because each ring positions itself diametrically as well as vertically. Header or follower rings are not always required because each Uneepac ring is a complete, self-protected unit.

To learn how Uneepac may aid your new equipment design, too, write for booklet PK-58A. Just address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

Johns-Manville PACKINGS & GASKETS



Weatherhead Brass Fittings connect air lines in the Cleveland Electric Illuminating Company's Lakeshore Steam Power Station, Cleveland, Ohio

Do You Get All This When You Buy Brass Fittings?

- ☐ QUALITY MATERIALS AND MANUFACTURE?
- ☐ SIMPLIFIED ORDERING AND INVENTORY?
- ☐ PROGRESSIVE DESIGN?
- ☐ FIELD ENGINEERING SERVICE?

* those who buy WEATHERHEAD do!

A guide to the quality of Weatherhead fittings is their use by America's leading industrial firms. Weatherhead earned this acceptance in the past —and holds it today—by insistence on the best materials, the most careful manufacture, the greatest emphasis on design and engineering.

You can see the results in Weatherhead Brass Fittings. Weatherhead pioneered the technique of machining them from extruded brass to give strength equal to forgings and complete freedom from seepage. Weatherhead designers planned the large, flat wrench pads for easy gripping. And because Weatherhead's line is complete, you can order from one supplier and carry one inventory for all your requirements. **FOR ALL THE FACTS,** get Catalog F-1456. Write: The Weatherhead Company, Dept. A, 300 East 131st Street, Cleveland 8, Ohio.

YOU'RE AHEAD WHEN YOU SPECIFY . . .

WEATHERHEAD

This trademark (W) appears on every make of car, truck, bus, and tractor (W) on equipment for machine tools, diesel and hydraulic applications (W) on equipment for instrumentation, oil drilling, mining, road building (W) for aircraft, railway, and marine engines (W) for LP-Gas and anhydrous ammonia control equipment (W) this symbol represents more than 1800 products made by Weatherhead . . .

NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

HYDRAULIC COUPLINGS
. . . are reusable

Designation: Hydralink
Size: Standard range of sizes for both one and two wire braided
Design: 90 degree swivel elbows are designed for high pressure hydraulic equipment and are leakproof. A full range of sizes for all standard applications is available. Elbows are designed so that they can be adjusted to any angle in their relationship to the other connections.

Feature: Engineered for an easy "on the job" installation. Both fixed and swivel male end couplings are available. The high pressure couplings will withstand pressures greater than the rated burst pressures of the wire braid hose and other types of couplings. A complete line of adapters and fittings for all standard installations is available.

Cosdomatic Co., Inc.,
New York City
Circle 190 on Reader Service Card

4-WAY VALVE
. . . with integral relief

Designation: Model No. 126
Size: Port sizes: Inlet and outlet—¾" pipe thread, cylinder openings ½" pipe thread.
Design: A 4-way hydraulic control with a pressure balanced sliding spool suited for operating hydraulic loaders, dumps, push-offs and industrial hydraulic equipment.
Features: Adjustable pressure relief valve; control lever mountable in any of four positions; longer mounting feet for easier valve mounting on flat surfaces; finger grip control handle drilled for remote control rod; working pressure to 1500 psi; self centering feature permits the spring loaded handle to return to neutral or hold position. In this position the hydraulic cylinder is held and the pump flow is bypassed back to the oil reservoir.

Groban Supply Co.,
Chicago 5, Illinois
Circle 191 on Reader Service Card

DOUBLE SEAL BALL VALVE
. . . has non-turbulent flow

Size: From ¼" to 2" inc.
Design: The ball type valve permits full, round, non-turbulent flow of air or oil. Positive shut-off is maintained under vacuum and even under extreme abrasive and corrosive service conditions at 300 and 600 psi working pressures. Valve opening and closure is effected through ¼ turn of lever handle.
Construction: Use of the double seal ball principle has made possible production of valves in aluminum, brass, bronze, monel, stainless, carbon steel and other wrought alloys, with seats and packings in Buna-N, neoprene, silicone and Kel-F. Valves are available in the same material as the pipe itself, thereby eliminating the electrolytic action and corrosion which results in valve failure.

Service: No lubrication required. Valve stem may be removed for repacking while the valve remains in the line.

Jamesbury Corp.,
Worcester 8, Mass.
Circle 192 on Reader Service Card

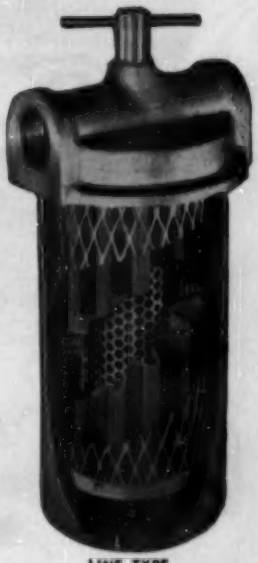
For more NEW PRODUCT reviews turn to page 154

SUMP TYPE (Cutaway)

When You Need A Filter— Get The Advantages Of Marvel SYNCLINAL Design

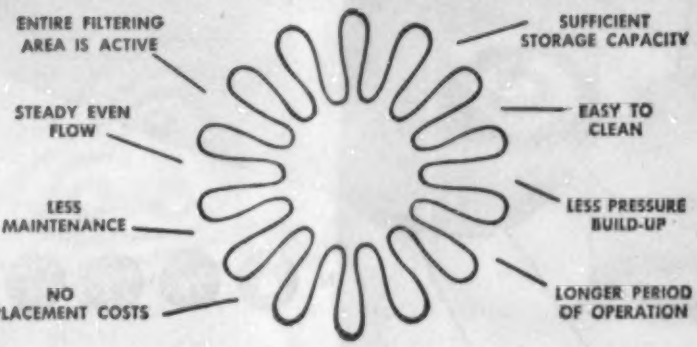
It's BALANCED

For Top Performance!



LINE TYPE (Cutaway)

LOOK FOR THESE IMPORTANT FEATURES



For All Hydraulic and Other Low Pressure Liquid Systems

In the selection of a filter to obtain maximum efficiency and quality, the most important point to consider is a specific type filter that will offer greatest ACTIVE filtering area with ample storage capacity for filtered out particles, rather than total filtering area alone. Over 475 Original Equipment Manufacturers install Marvel Synclinal Filters as Standard Equipment because they are designed to give this all-important balance for greatest efficiency in filtration of liquids in all hydraulic and other low pressure circulating systems. Flow of liquids is maintained at a constant, steady rate of speed produced by the pump which brings about the desired effect of a gentle, evenly distributed accumulation of filtered out particles against the entire filtering surface with less restriction of flow. Result—longer periods of productive operation at minimum maintenance down-time. If this important balance is lacking due to efforts to cram too much filtering mesh for the sake of total rather than active area, filters soon become clogged causing pressure build-up, turbulent flow and in general decreases the efficiency of operating equipment. Depend on Marvel Synclinal Filters For All Your Filtration Requirements.

EASY MAINTENANCE

Both sump and line types may be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be obtained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

FILTERS FOR NON-FLAMMABLE HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of non-flammable hydraulic fluids.

IMMEDIATE DELIVERY!

As in the the past, Marvel continues to offer IMMEDIATE DELIVERY.

Catalogs containing complete data available on request Write or Mail Coupon

MARVEL ENGINEERING COMPANY

625 W. Jackson Blvd., Chicago 6, Ill., Phones: FRanklin 2-3530 & FRanklin 2-4431

Without obligation, please send me complete data on Marvel Synclinal Filters, as follows:— AH-10

- ☐ Catalog #106—For Hydraulic Oils, Coolants and Lubricants
- ☐ Catalog #300—For WATER
- ☐ Data on filters for Non-flammable hydraulic fluids.

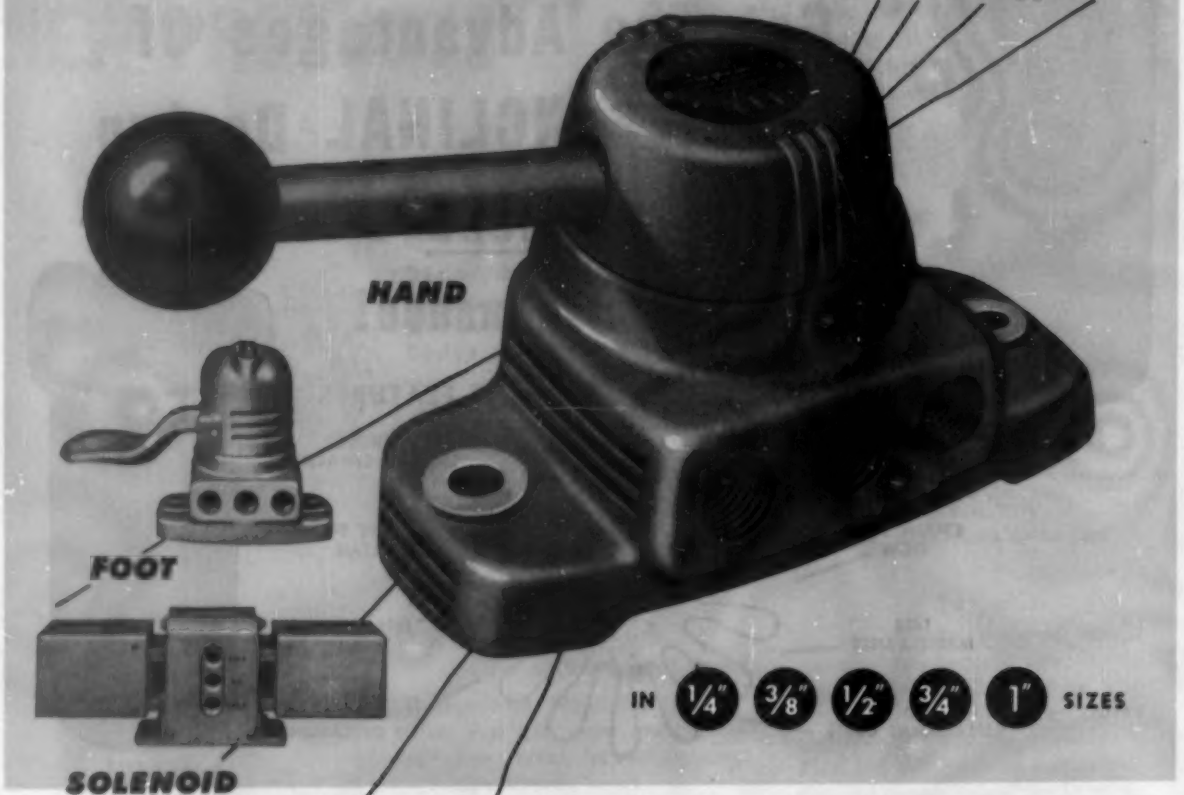
Name ..... Address .....

Title ..... City .....

Company ..... State .....

AIR VALVES

RIVETT offers all sizes and types!



PILOT VALVES IN SIDE AND FOOT MOUNTINGS, IN PALM, PUSH BUTTON, CAM, FOOT AND SOLENOID OPERATION

You can gain more effective use of air power with Rivett air valves. Not only is there a wide selection from which to plan your circuit, but you can rely on Rivett valves to provide more dependable service.

Recommended for pressures up to 150 P.S.I., these valves are designed with large, convenient pipe connections permitting unrestricted air flow.

RIVETT LATHE & GRINDER, Inc.
Department AH-10 Brighton 35, Boston, Massachusetts

RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS
Air and Hydraulic
All sizes and types

Free Literature Offered in this Month's Ads

For more information circle numbers on the reader service card bound in this issue on page 189.

A new catalog, for Electro-Dynamic industrial **motors**, has been released. Also available is a comparative test report called "Motor Showdown". This material will assist you in the selection of electric motor drives for pumps and compressors.

Circle 61 on Reader Service Card

Two catalogs have been released by The S-P Mfg. Corp. Catalog 102 describes the standard **air cylinders** and catalog 109, their heavy duty units designed specifically for automatic machinery use where downtime hours must be kept low.

Circle 149 on Reader Service Card

Plant expansion of Warner Division of Detroit Harvester Company enables the company to take on additional precision subcontracting work for aircraft and ordnance plants. An illustrated booklet describes the complete facilities.

Circle 173 on Reader Service Card

For complete application and engineering data on reciprocating **rotary power**, write the Hydromotor Division, The Bonnot Company, for bulletin 21. This bulletin describes their **rotary reciprocating actuator** which is a single vane device powered by hydraulic pressure.

Circle 97 on Reader Service Card

Cylinders for oil pressure to 750 psi and air to 200 psi are presented in bulletin SM-454-2, offered by The Tomkins-Johnson Co.

Circle 162 on Reader Service Card

Valve bulletin No. 257 is available from Hanna Engineering Works. A complete line of hand, foot, electric and pilot operated valves for directional and speed control, is included. These for are applied to air and low pressure hydraulic circuits.

Circle 84 on Reader Service Card

Continued on page 55

On hydraulic applications LATTICE BRAID* Flax Packing holds together even when worn, outlasts ordinary packings 3 to 1

*Registered Trademark. Only Garlock makes LATTICE BRAID rod and shaft packings.

Check these typical service reports:

- *Locomotive Manufacturer*—Hydraulic pumps handling water, 1,500 to 2,000 p.s.i. Garlock 745 LATTICE BRAID Flax packing gives from 4 to 12 months service where previous braided packings lasted a maximum of a few weeks.
- *Steel Company*—Hydraulic accumulator handling cold water, 5,000 p.s.i. Best service from previous packings 6 weeks to 2 months. Garlock 745 LATTICE BRAID Flax packing lasts 6 months, rings form better in stuffing box, do not tear in service.
- *Rubber Company*—Hydraulic presses handling water, 160° F., 2,100 p.s.i., ¾" packing, plungers worn and rough. Maximum service from previous packings 1 month. Garlock 745 LATTICE BRAID Flax packing lasts 4 months.
- *Steel Company*—Hydraulic accumulator handling water, 800 p.s.i., 48" ram, 1" packing. Previous packings lasted 6 to 8 months. Garlock 740 LATTICE BRAID Flax packing gives 2½ years service.

Get all the facts about LATTICE BRAID *Packings. Contact your Garlock representative or write for new folder AD-131.*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

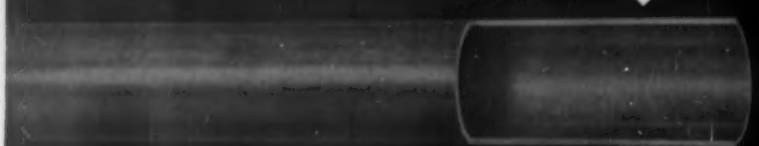
Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland Denver • Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N. Y.) • Philadelphia Pittsburgh • Portland (Oregon) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK LATTICE BRAID PACKING

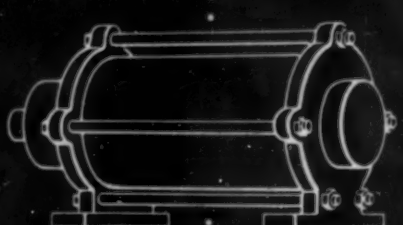
Rockrite
cylinder finish tubing

inside size and surface
just right for a piston



just cut off

and assemble . . .



that's all

No inside boring or reaming for soft-packed pistons. Only a light hone for hard packed pistons. Slashes finishing costs—big savings from interchangeability of pneumatic and hydraulic pump parts. For details ask for Bulletin R7.

TUBE REDUCING CORPORATION
Wallington, New Jersey
AFFILIATE OF AMERICAN METAL PRODUCTS CO.

JOSEPH T. RYERSON & SON, INC., NATIONAL WAREHOUSE DISTRIBUTORS

ROCKRITE TUBING

Free Literature Offered in this Month's Ads

Continued

A manual, MP-200, consisting of engineering standards for **molded packings** is available from Greene, Tweed & Co.

Circle 79 on Reader Service Card

An **air motor** story told in a 36 page booklet is available from The Bellows Company. Information on the application and selection of air cylinders is fully detailed with drawings and charts.

Circle 29 on Reader Service Card

Complete information can be obtained on **radial piston pumps** made by Simplex Engineering Co. Pumps develop high pressures of 3000 psi to 10,000 psi. These small volume high pressure pumps are widely used for high pressure holding operations.

Circle 144 on Reader Service Card

Contained in catalog and manual 201-A are the latest JIC and recommended sizes for cups, flanges, U's, V's, and "O" ring **packings.** Also included in this literature prepared by Graton & Knight are facts on oil seals.

Circle 78 on Reader Service Card

Bulletin #177 describes **separators** and **aftercoolers** manufactured by R. P. Adams Co. Inc. Used on compressed air circuits these units increase efficiency and reduce maintenance costs.

Circle 2 on Reader Service Card

Catalog No. 553 describes the complete line of **tube** and **pipe fittings,** offered by Fiodar Corporation. Included are engineering data, installation instructions and tubing recommendations. Both flare and flareless fittings for high pressure hydraulics are described.

Circle 67 on Reader Service Card

Safety hydraulic fluids are discussed in detail in a booklet "Ucon Hydrolubes" released by Carbide and Carbon Chemicals Company. This water-base fire-resistant fluid reduces the fire hazard on hydraulic machines located in "hot" areas.

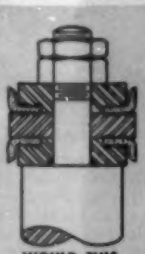
Circle 37 on Reader Service Card

Continued on next page

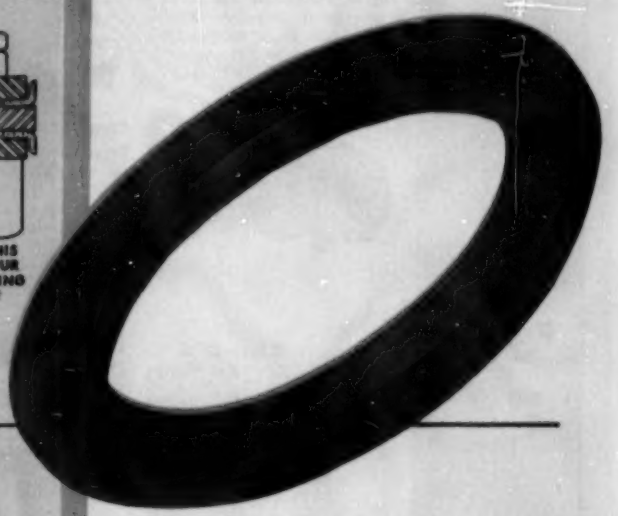
quality control

MARSH IMPREGNATED LEATHER PACKINGS

to your specifications



WOULD THIS SOLVE YOUR ENGINEERING PROBLEM?

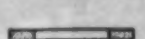


CUP PACKING

FLANGE PACKING

U PACKING

VEE PACKING



NON-EXTRUSION WASHER

DIAPHRAGM

Your packing problem—where quality control determines the successful application—has a solution! MARSH with more than half a century of experience plus continuous on-the-job and laboratory research, supplies the mechanical leather packing for your job—cut, formed, treated, engineered to meet YOUR SPECIAL REQUIREMENTS.

MARSH Field Engineering and Consulting Service, quickly available, helps you determine the specific leather packing for greatest efficiency, longer wear, lower cost — for your job.

MARSH PACKINGS, selected, tanned, impregnated to the job specifications, provide superior custom leather sealing with —

- **Low coefficient of friction** both static and running
- **Greater wear resistance** combining toughness with strength
- **Tighter sealing** proper impregnation for varied pressures
- **Temperature stability** through a wide range of temperatures

ENGINEERING and CONSULTING SERVICE

If you seal oil, water, air, vacuum, gas, gasoline, naphtha, alcohol, or other fluids, ask MARSH for field engineering service, immediately available to you for the job you are designing, tooling, manufacturing.

WRITE FOR ENGINEERING HANDBOOK AND TECHNICAL LITERATURE

C. W. MARSH COMPANY

Main office and Factory Muskegon, Mich.

SALES OFFICES: 75 E. Wacker Drive, Chicago 1, Illinois · 101 Park Avenue, New York 17, N. Y. · 548 S. Border Road, Winchester, Mass. · 1900 Euclid Avenue, Cleveland 15, Ohio

Circle 113 on Reader Service Card

★ *SINCE 1926* ★ *in the application, design & mfg. of pumps — separators — hydraulic accessories.*

EQUIPMENT FOR FLUID POWER TRANSMISSION

Primary Oil Pumps

Class 50 Pumps

Direct connected oil pumps for general pressure circulation of oil. High suction lift; pressures up to 100 psi.
Ask for Bulletin A-1330

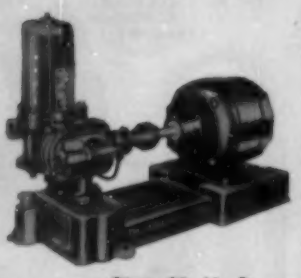
Class 60M Pumps

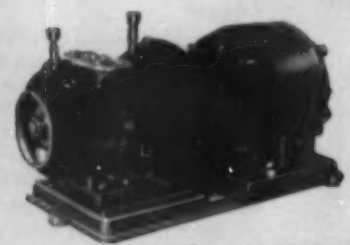
Designed for general industrial oil supply. Direct-connected for light oils, reduction-drive for heavy oils. Capacities to 200 gpm.
Ask for Bulletin A-1267

Vacuum-Powered Transmission and Low-Pressure Air Service

Class 21 & 25 Air Pumps

Oil lubricated pumps —vacuums up to 28" mercury; wide range pressures.
Ask for Bulletin A-1289





Class 23 Air Pumps

Designed for mechanical suction and pressure requirements for the printing and packaging machinery fields.
Ask for Bulletin A-1399

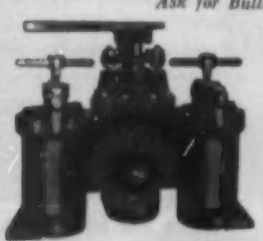
Air Filters

Class 26 Air Filters

Originally designed as integral part of Kraissl oil-lubricated air pumps—now available for independent applications; remove all oil vapors and pipe condensates in compressed air lines.
Ask for Bulletin A-1184

Class 72A Dust Separators

Mounted at vacuum pump intake, minimizes entry of dust, shavings, extraneous matter. Saves its cost in maintenance time. Sizes ⅜" to 2½".
Ask for Bulletin A-1409



Class 72 Separators

Remove extraneous matter from hydraulic circulation lines. Single and duplex strainers and filters—for both standard and high pressure installations. Sizes ¼" to 6".
Ask for Bulletins 1430-1431-1214

KRAISSL CO. Inc.

305 Williams Ave., Hackensack, N. J.

Circle 104 on Reader Service Card

Free Literature Offered in this Month's Ads

Continued

Industrial **hydraulic equipment** for every application is presented in bulletins prepared by Adel Division of General Metals Corp. Valves and pumps for 1000 to 1500 psi service are described.

Circle 3 on Reader Service Card

You may write Chikson Company for their latest industrial catalog, G-4, on ball bearing **swivel joints.** Designed to give unlimited flexibility in piping hydraulic systems.

Circle 46 on Reader Service Card

Complete data on **air** and **hydraulic cylinders** is available from Carter Controls, Inc. The bulletins supply information on dimensions, parts, and specifications.

Circle 40 on Reader Service Card

An engineering handbook and technical literature is offered by C. W. Marsh Company. The booklet includes dimensional and application data on **leather packings.**

Circle 113 on Reader Service Card

New **solenoids** are described in bulletin GEA-6215, offered by General Electric. Complete information is given as to ratings, sizes and features.

Circle 76 on Reader Service Card

Bulletin, on **air control valves,** may be secured from Automatic Valve Co. Many different types are included.

Circle 23 on Reader Service Card

"Report on Conpor", with full information on this new material, is available from Chicago Rawhide Manufacturing Company. It is a seal and **packing** material that permits complete porosity control.

Circle 45 on Reader Service Card

Complete information on **Teflon parts** and products is available in a 12 page illustrated catalog, "The Best in Teflon". Write to Crane Packing Company.

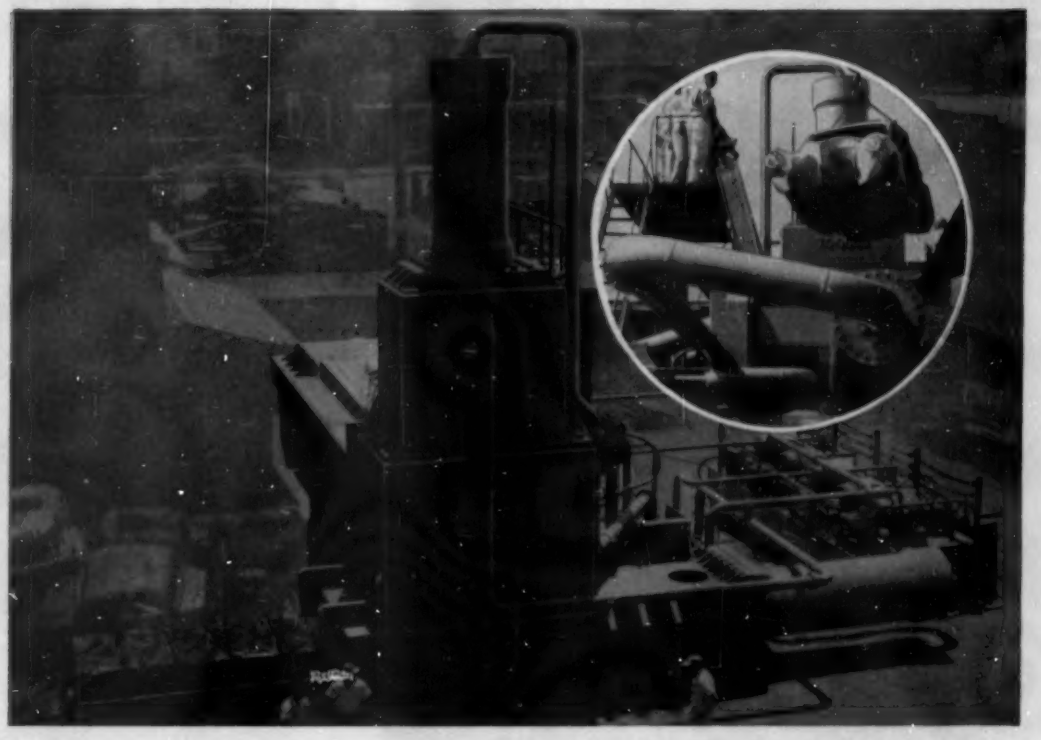
Circle 50 on Reader Service Card

Illustrated catalogs may be obtained on The A. K. Allen Co., **air cylinders,** valves and clamps are described.

Circle 12 on Reader Service Card

Continued on page 59

world's largest scrap-baling press gets HONAN-CRANE Oil Purification!



An outstanding example of industry's modern, push-button miracles is the new TG-3000, gigantic scrapmetal baling press specially built by the Harris Foundry & Machine Company for the Chicago Auto Wrecking Corporation.

Weighing 675,000 pounds, the huge, 800-horsepower press is capable of baling up to 75 tons per hour. It actually can compress two or more complete autos simultaneously into neat packages measuring about 24" x 24" x 60" each.

HONAN-CRANE OIL PURIFIER PROTECTS 3700 GALLON HYDRAULIC SYSTEM

The TG-3000 requires a hydraulic system containing 3700 gallons of high grade hydraulic oil. Push-button controls connected to the hydraulic circuit make the press manual, semi-automatic or fully automatic in operation.

To insure against costly breakdowns in this complex system, the Harris Company will equip it with a Honan-Crane Bulk-Type Oil Purifier as shown at left. Honan-Crane purification protects vital hydraulic mechanisms, extends safe-use life of oil, insures maximum operating efficiency and economy.

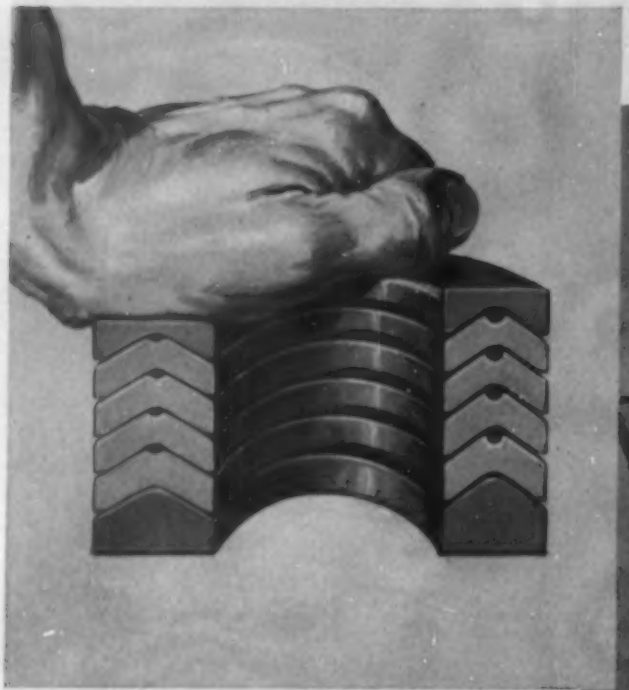
Give your plant the benefit of Honan-Crane's 30 years' filtration experience. There's a Honan-Crane Purifier for complete removal of either solid or soluble contaminants from hydraulic, lubricating, metal-working, insulating and other oils.

Write for engineering bulletins covering your specific problem

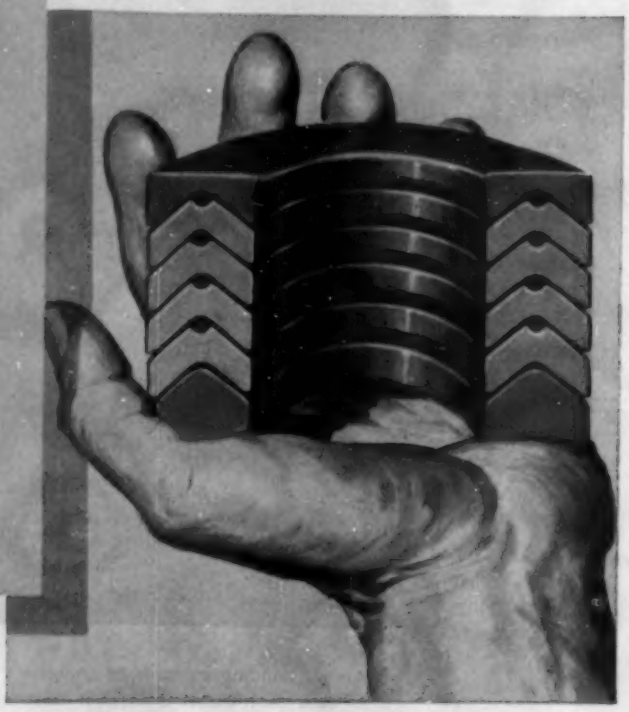
HONAN-CRANE
Oil Purification Equipment

Honan-Crane Corporation
102 WABASH AVENUE, LEBANON, INDIANA
A subsidiary of
Houdaille-Hershey Corp.

See for yourself how U. S. Matchless Packing reduces wear on rods, reduces packing costs



This demonstration set of U. S. Matchless has been cut in half. When set is squeezed by hand, note how the lips spread out. Then note what happens when the pressure is released...



When pressure is released, the lips retract. This action duplicates what happens when U. S. Matchless is subjected to hydraulic pressure *plus* subsequent release, as on a reciprocating rod or hydraulic ram.

The photos above show how pressure (whether gas or fluid) forces the double pliant lips of U. S. Matchless® Packing against the rod and side of the stuffing box. *This self-adjusting, automatic action plus the blunt edge design reduces wear on the rods, prolongs packing life and hence lowers maintenance costs.*

U. S. Matchless is recommended as original equipment by some of the largest makers of hydraulic presses and makers of rotary oil drilling rigs. It is ideal for rams, accumulators, triplex pumps and oil well swivels. It is designed to handle hot and cold water, brine and ammonia, hot and cold oils, crudes, gasoline and all petroleum products, and is a favorite of manufacturers of liquid or gaseous materials.

U. S. Matchless Packings are obtainable through any of our selected distributors or any of our twenty-seven District Sales Offices, or by writing the address below.

"U. S." Research perfects it.
"U. S." Production builds it.
U. S. Industry depends on it.

US RUBBER

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes
Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

Free Literature Offered in this Month's Ads

Continued

Valves for air and oil power, is the subject of a new catalog offered by W. H. Nicholson & Co. Available in sizes from 1/8" to 2-1/2" and pressures up to 5000 psi.
Circle 123 on Reader Service Card

Complete catalog on the Air-Mite Devices, Inc., air arbor press and **air cylinders** is available. The air cylinders are specifically designed for tooling applications. Small clamp cylinders are featured.
Circle 7 on Reader Service Card

Bulletin 1010 describes the Ledeen Mfg. Co.'s power operated **valves.** How instant action is obtained of remotely located or automatically operated cylinders, is explained.
Circle 106 on Reader Service Card

Piston packing, for air and hydraulic mechanisms, is described in bulletin No. 4502, released by Darling Valve & Manufacturing Co.
Circle 52 on Reader Service Card

Do you need information on ball, revolving, swivel and swing **joints?** You may obtain it from Barco Manufacturing Co. They are offering 8 catalogs on the subject.
Circle 25 on Reader Service Card

Information on **"O" rings** and **custom-molded rubber** can be obtained from The Parker Appliance Company. Catalog on the "O" rings is No. 5100 and the one on the molded rubber is No. 5201A1.
Circle 129 on Reader Service Card

Several bulletins are available from Kraissl Co. Inc., covering equipment for fluid power transmissions. Some of the bulletins offered are on **oil pumps, air pumps, air filters** and **dust separators.**
Circle 104 on Reader Service Card

Electro-magnetic **shut-off valves** are described in catalog 53-A. They provide high pressure and high flow capacity. Write to General Controls, Inc.
Circle 75 on Reader Service Card

Brochure 301-A gives technical data on the Greer Hydraulics, Inc., **accumulator.** Selection techniques and applications of this bag type hydro-pneumatic accumulator are presented.
Circle 80 on Reader Service Card

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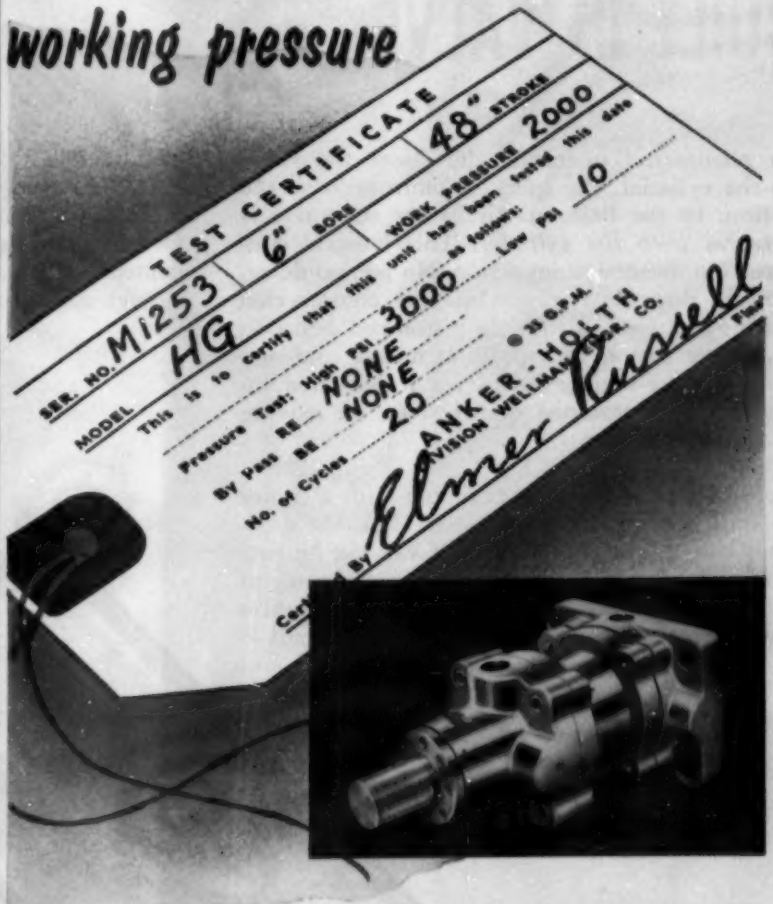
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SER. NO. M1253
6" BORE
48" STROKE
MODEL HG
WORK PRESSURE 2000
This is to certify that this unit has been tested this date as follows:
Pressure Test: High PSI 3000 Low PSI 10
By Pass RE NONE
No. of Cycles 20
ANKER-HOLTH DIVISION WELLMAN ENGR. CO.
By Elmer Russell

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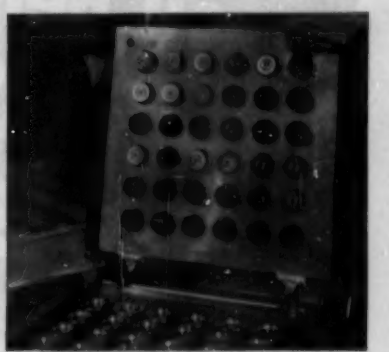

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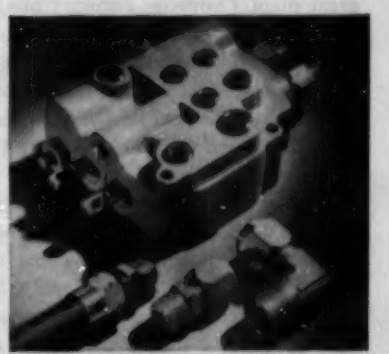

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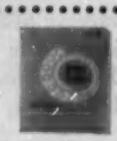

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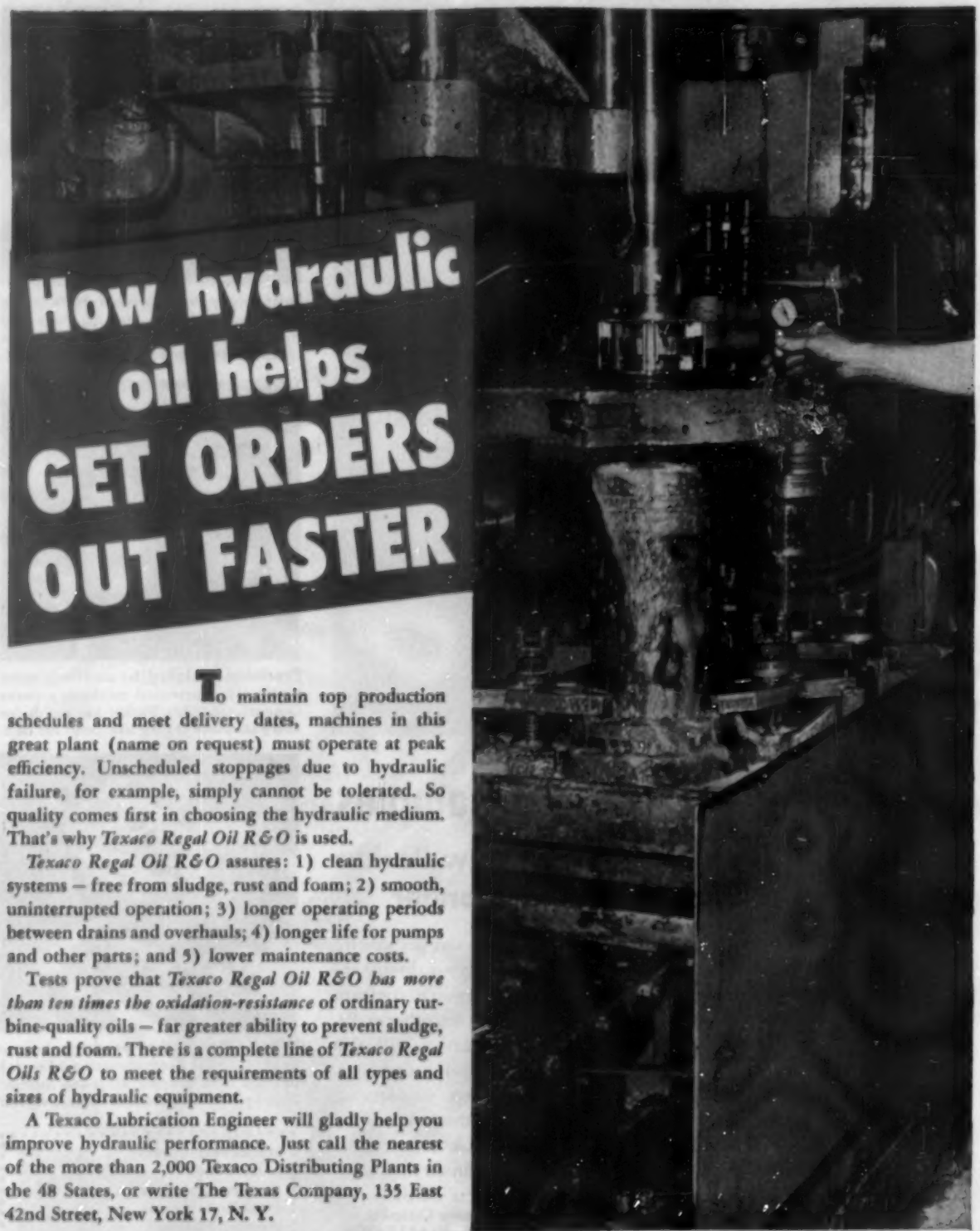

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Carl E. Schmitz
Director
1954 Conference

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS 1954

THE Tenth Anniversary National Conference on Industrial Hydraulics will be held at the Hotel Sheraton, Chicago, on Thursday and Friday, October 14 and 15. Sponsored by the graduate school of Institute of Technology and Armour Research Foundation, with the cooperation of engineering societies and the hydraulic industry as a non-profit, non-commercial undertaking, the first technical meeting, then called "Conference on Hydraulic Machinery", held in 1945 attracted an attendance of 110 men. Success of the first conference encouraged the sponsors to hold annual meetings. The present title, National Conference on Industrial Hydraulics, was chosen as more representative to describe the extent of the interest of the steadily increasing number of men who attended in succeeding years. Last year over 700 persons registered for the 1953 Conference. Registration is expected to exceed 800 persons for the Tenth Anniversary Conference.

Carl E. Schmitz, vice president in charge of sales, Crane Packing Company is Director of the 10th Anniversary Conference. V. L. Streeter, Professor of Civil Engineering, University of Michigan, one of the original founders of the Conference, is Associate Director. Director Schmitz states that the nine technical sessions of the 1954 Conference will hear what is perhaps the outstanding group of papers and panel discussions at any meeting of NCIH. For the first time a session will be devoted to pneumatic controls, a recognition of the close relationship between hydraulic and pneumatic equipment. Another session will be devoted to aircraft controls. The session on fire resistant or nonflammable hydraulic fluids will be restricted to one paper. The extra time will be given over to discussions by a large panel of both users and suppliers of these fluids. The widespread interest assures an active period, which will include, as will all technical sessions, discussion from the floor.

The plans of the Conference follows that of previous years. A general session will follow registration on the first morning. In the afternoon and at both morning and afternoon sessions on the second day, three sessions will be held concurrently. Meeting rooms are closely grouped for the convenience of registrants in attending various sessions for specific papers or discussions.

J. O. Reinecke
Keynote Speaker
"The Power of Design"

Allen Perry
Chairman
Machine Tool Session

Ernst Weidman
Chairman
Pump Session

J. C. Hanna
Chairman
Heat Dissipation Session

•PROGRAM:

Thursday, October 14, 1954

8:30 A.M. Registration: Sheraton Hotel, Grand Ballroom Foyer

10:00 A.M. MORNING TECHNICAL SESSION

GENERAL SESSION: Grand Ballroom
Chairman: Carl E. Schmitz, Vice President in Charge of Sales, Crane Packing Company, Chicago, Ill.
(1) "The Power of Design." J. O. Reinecke, Reinecke & Associates, Chicago, Ill.
(2) "Hydraulic Problems Encountered During the Development of Corps of Engineer Equipment." K. L. Treiber, Hydraulic Consultant, Engineer Research and Development Laboratories, Fort Belvoir, Va.

2:00 P.M. AFTERNOON TECHNICAL SESSIONS

MACHINE TOOLS: Grand Ballroom
Chairman: Allen Perry, District Manager, Vickers, Incorporated, Cincinnati, Ohio
(1) "Trends in the Design of Automation." Kurt O. Tech, Chief Engineer, The Cross Company, Detroit, Mich.
(2) "Hydraulics as Applied to Automation." Walter Schroeder, Project Engineer, Cincinnati Milling Company, Cincinnati, Ohio.

PUMPS: Boulevard Room
Chairman: Ernst Weidmann, Chief Engineer, The Oilgear Company, Milwaukee, Wis.
(1) "Evaluating Piston Pumps and Motors for High Performance Hydraulic Systems." R. H. Marvin, Section Chief, The Franklin Institute Laboratories for Research and Development, Philadelphia, Pa.
(2) "Servo Controls as Applied to Variable Displacement Pumps." J. Wesley Broome, Section Head, Servomechanisms Department, Raytheon Manufacturing Company, Inc., Newton, Mass.
Panel Members: Walter Ernst, Vice President and Director of Engineering, The Commonwealth Engineering Company of Ohio, Dayton, Ohio; J. L. Shearer, Assistant Professor of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

HEAT DISSIPATION: Tropical Room
Chairman: J. C. Hanna, Vice President and Chief Engineer, Hanna Engineering Works, Chicago, Ill.
(1) "Heat: Its Generation and Natural Dissipation in Hydraulic Circuits." J. K. Douglas, Development Engineer, The Oilgear Company, Milwaukee, Wis.
(2) "Heat: Forced Convection Removal from Industrial Hydraulic Circuits." D. W. Retzinger, Contract Products Division, Young Radiator Company, Racine, Wis.
Panel Members: D. P. Morrell, Supervisor, Fluids and Electrical Section, Design and Standards Department, Ford Motor Company, Dearborn, Mich.; J. R. Hemeon, Hydraulic Equipment Engineer, Ternstedt Division, General Motors Corporation, Trenton, N. J.

6:30 P.M. ALL SOCIETY BANQUET: Grand Ballroom

Toastmaster: Harold S. Ellington, President, Harley, Ellington & Day, Inc., Detroit, Mich.
Speaker: A. W. Merrell, Assistant to the President, Ford Motor Company, Dearborn, Mich.

Friday, October 15, 1954

9:30 A.M. MORNING TECHNICAL SESSIONS

PRESSES: Grand Ballroom
Chairman: C. H. Scheurman, Field Engineer, Pump and Control Division, Denison Engineering Company, Chicago, Ill.
(1) "Unit Mounting of Pump and Control Units Directly on the Cylinder." F. G. Cizek, Assistant Chief Engineer, American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio.

OF THE NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS

(2) "The Verson-Wheelon Direct Acting Hydraulic Press." G. F. Rohrscheib, Verson Allsteel Press Company, Chicago, Ill.
Panel Members: G. H. Case, Vice President, Williams, White and Company, Moline, Ill.; R. Norman, Chief Engineer, Hydraulic Press Manufacturing Company, Mount Gilead, Ohio.

LIFT TRUCKS: Boulevard Room
Chairman: Joseph F. Ziskal, Chief Engineer, Hydraulic Division, Tractor Works, International Harvester Works, Chicago, Ill.
(1) "Hydraulic Valves and Systems for Lift Truck Operation for Various Material Handling Needs." E. J. Hrdlicka, Manager, Hydreco Division, The New York Air Brake Company, Cleveland, Ohio.
(2) "Hydraulics Add Versatility to Modern Lift Trucks." F. C. Schuster, Chief Engineer, Material Handling Division, The Buda Company, Division of Allis Chalmers Manufacturing Company, Harvey, Ill.
Panel Members: Ted Stephens, The Parker Appliance Company, Cleveland, Ohio; Jerome Tiskus, Assistant Chief Engineer, Automatic Transportation Company, Chicago, Ill.

PNEUMATIC CONTROLS: Tropical Room
Chairman: R. R. Stevens, Sales Manager, Eastern Region; Industrial Products Division, Westinghouse Air Brake Company, Washington, D. C.
(1) "Development of Valves for the Control of Pneumatic Power." S. Y. Lee and J. L. Shearer, Assistant Professors of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.
(2) To be announced.

2:00 P.M. AFTERNOON TECHNICAL SESSIONS

HYDRAULIC FLUIDS (Fire Resistant): Grand Ballroom
Chairman: R. Q. Sharpe, Staff Engineer, Lubricating Department, Socony-Vacuum Oil Company, New York, New York.
(1) "Effects of Hydraulic Fluids on Synthetic "Rubber." H. C. Crosland, Technical Director, Sirvene Division, Chicago Rawhide Manufacturing Company, Chicago, Ill.
(2) Because of the extreme interest in industrial fire resistant fluids the remainder of this session will be devoted to a panel discussion with a question and answer period. Panel members will include users and suppliers of fluids, pumps and packings.
Panel Members: F. L. Mackin, Chairman, Machine and Wood Shops and Hydraulics, General Motors Institute, Flint, Mich.; G. B. Miller, Chief Engineer, Racine Hydraulics and Machinery Incorporated, Racine, Wis.; W. N. Whitney, Superintendent of Engineering, Delco-Remy Division, General Motors Corporation, Anderson, Ind.; J. S. Harris, Supervisor, Functional Fluid Sales, Monsanto Chemical Company, St. Louis, Mo.; P. H. Lavely, Manager, Oven Machinery Branch, Koppers Company, Inc., Pittsburgh, Pa.; W. H. Millett, Special Products Department, Carbide & Carbon Chemicals Company, A Division of Union Carbide & Carbon Corporation, New York, New York; J. L. Rayniak, Vice President, Johnson Motors, Waukegan, Ill.

AUTOMOTIVE: Boulevard Room
Chairman: J. T. Greenlee, Vice President, Imperial Brass Manufacturing Company, Chicago, Ill.
(1) "The Chrysler Power Flite Transmission." W. R. Rodgers, Supervisor, Mechanical Laboratories, Chrysler Corporation, Detroit, Mich.
(2) "Power for Power Steering." E. S. Witchger, Sales Manager, Pump Division, Eaton Manufacturing Company, Detroit, Mich.

AIRCRAFT CONTROLS: Tropical Room
Chairman: J. T. Marshall, Chief Engineer, Hamilton Division, Bendix Aviation Corporation, Hamilton, Ohio.
(1) "Jet Engine Control." J. M. Eastman, Senior Engineer, Bendix Aviation Corporation, South Bend, Ind.
(2) "Problems Encountered in Developing a Constant Speed Automatic Transmission for Aircraft Alternators." R. G. Doolittle, Group Leader Engineer, Aviation Division, Sundstrand Machine Tool Company, Rockford, Ill.

C. H. Scheurman
Chairman
Press Session

R. Q. Sharpe
Chairman
Hydraulic Fluids Session

J. T. Greenlee
Chairman
Automotive Session

J. T. Marshall
Chairman
Aircraft Controls Session

Summaries of

TECHNICAL PAPERS

Presented at 10th NCIH

Here are abstracts of the papers being given at the 10th annual Conference. During coming months, several of the complete papers will appear as articles in APPLIED HYDRAULICS. Complete Conference Proceedings will be published in the spring.

● *HYDRAULIC PROBLEMS ENCOUNTERED DURING DEVELOPMENT OF ENGINEER EQUIPMENT*

By K. L. Treiber, Chief Liaison Branch Engineering Research and Development Laboratories, Fort Belvoir, Va.

The paper will consist of a variety of hydraulic problems encountered at the Engineer Research and Development Laboratories, Fort Belvoir, Virginia.

The first problem is one on a centrifugal pump stuffing box encountered with a petroleum centrifugal pipeline pump with the solution.

Another problem dealing with petroleum pipeline pumps is the solution to the ever changing capacity requirements during a war. Pipeline pump was developed for 8 and 12-inch pipelines and also suitable for use on 6-inch pipelines. Pump may be considered as 2 pumps in one or single pump depending upon the desires of the user.

Solution to pump requirements for the 6-inch Army portable pipeline will be discussed.

The next subject is the refueling of large aircraft. The problems discussed here are the control means to regulate pressure at the hose that is connected to the plane refueling manifold, and the necessary couplings at the plane and at the hardstand surface.

The next subject is a discussion of the flexible pipe in "continuous lengths" that can be installed in a minimum amount of time.

Requirements for a storage container for water or gasoline that was designed at these Laboratories, and the solution to this problem by designing a collapsible container that will hold ten thousand gallons of liquid is detailed.

The next item discussed is the Armored vehicle launched bridge and hydraulic problems pertaining to this development.

Discussion will also be made on the problem encountered to mount a five thousand pound boom crane on a 5-ton 6x6 bridge truck in exteremly limited space and the solution was the construction of a hydraulic operated crane for the unloading of bridge equipment and the erection of the bridge tests.

● *HEAT: FORCED CONVECTION REMOVAL FROM INDUSTRIAL HYDRAULIC CIRCUITS*

By D. W. Retzinger, Contract Products Division, Young Radiator Co., Racine, Wis.

A general outline of factors affecting the transfer of heat by either air or liquid from hydraulic oil is given. The affect of the properties of the oil, mass flow, tube size, fin size and spacing, turbulance, fouling factors and materials of construction are discussed with respect to the heat transfer coefficients.

All transfer of heat must conform to the general equation $Q = UA(LMTD)$. The various components determine the transfer surface required to perform a given cooling job.

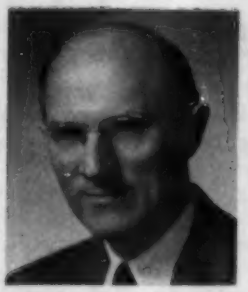
There are two general types of cooling systems, central and individual. The section on central systems embodies a schematic diagram illustrating piping and controls.

Three types of cooling equipment, evaporative cooler dry air type cooler and shell and tube Heat Exchangers for this service are discussed with regard to construction, method of operation, advantages and disadvantages.

Individual cooling systems include dry air type cooling and cooling by water in conjunction with a

K. L. Treiber

Ed J. Hrdlicka



J. K. Douglas

D. W. Retzlager

Shell and Tube Heat Exchanger. Their attributes, method of operation, and factors pertaining to the performance of the equipment are also considered.

● HEAT: ITS GENERATION AND NATURAL DISSIPATION IN HYDRAULIC CIRCUITS

By James K. Douglas, Development Engineer, The Oilgear Company, Milwaukee, Wisconsin.

When designing new types or sizes of hydraulically driven machines it is desirable to be able to predict whether or not natural heat dissipation will be sufficient to maintain a satisfactory operating temperature. The cost, space requirements, and availability of cooling media for forced cooling of a machine have an appreciable effect on the price and design of the machine so that the need for such cooling should be known before the price and design are established.

The author found that detailed calculations of the heat dissipation rate proved to be cumbersome and less accurate than a simpler system of analogy or comparison with machines of known characteristics. So data is presented regarding several typical machines which provides a simple means of determining the natural heat dissipation of many hydraulic machines.

Data is also presented on methods of determining the heat generated by hydraulic systems, particularly the variable delivery pump type, so that the final operating temperature with natural heat dissipation can be estimated with a fair degree of accuracy.

The subject will be illustrated by photographs, curves, and tables of coefficients.

● HYDRAULIC CONTROL VALVES AND CIRCUITS AS APPLIED TO LIFT TRUCKS

By E. J. Hrdlicka, Hydreco Division, The New York Air Brake Company

The paper shows the functions of a lift truck and describes the part hydraulic components provide in accomplishing these objectives of lift truck performance.

Good hydraulic control is emphasized in stressing the safety of lift truck operation. Examples of hydraulic control are shown by the use of circuit charts and slides of cut-away sections of conventional control valves.

Desirable design characteristics of control are described, highlighting the importance these characteristics play in developing and improving material handling functions.

General comments on the advantages and disadvantages of the hydraulic circuits in use today are presented.

Hydraulic drives and transmission in lift trucks are also reviewed.

Future trends for providing hydraulic controls in the lift truck industry are also reviewed.

● HYDRAULICS AS APPLIED TO AUTOMATION

By Walter Schroeder, Project Engineer, The Cincinnati Milling Machine Co., Cincinnati, Ohio.

The milling operations for many parts contained in business machines, sewing machines, electrical apparatus, fire arms etc. used to be performed on hand operated and hand fed milling machines. When automatic operation became desirable it was recognized that the existing controls on a milling machine were inadequate. On conventional machines the successive events of a milling cycle are signaled by trip dogs from the moving table. Such cycles can not include movement of the spindle carrier, or loading and clamping operations of the parts, while the table is stopped.

The automatic cycle box was developed to meet these requirements of the industries mentioned above. It has been used as central cycle selector to control thousands of Cincinnati 0-8 Automatic and 2-24 Automatic milling machines. The heart of the cycle box is the assembly of usually four plate type control cams plus several ratchet wheels and a detent star wheel into a small cylindrical unit. This rotary cam unit determines the entire program, it can be exchanged for another one and mounted quickly. It is also the only mechanical item in this automatic control, all other elements being hydraulic.

These include hydraulic trip plungers at various stations of the machine receiving their signals from moving dogs and causing index motion of the cam unit by means of ratchet plungers. The commands then reach the control valves which energize hydraulic cylinders, clutches etc. at the proper moment of sequential operation. The production planner is thus provided with complete freedom over all table cycles, rise and fall spindle carrier cycle, spindle rotation

and stop, cutter retraction, backlash eliminator, coolant flow; also work loading, clamping and indexing etc.

The paper presents the principle involved and the general detailed design solution of the problem. It concludes with several typical applications of this hydraulic mechanism to effect automation. The achieved result exceeds by far the original task of relieving monotonous manual work.

Walter Schroeder

R. H. Marvin

● EVALUATING PISTON PUMPS AND MOTORS FOR HIGH PERFORMANCE HYDRAULIC SYSTEMS

By R. H. Marvin, Section Chief, The Franklin Institute Laboratories for Research & Development, Philadelphia, Pa.

Demand for increased accuracy and response of hydraulic transmissions for industrial and military applications requires a thorough understanding of the requirements of the components that are to be used. The discussion is limited to a commonly used form of variable speed transmissions, one that is composed of a constant speed, variable displacement machine hydraulically coupled to a fixed displacement machine. The output of the fixed displacement element is thus controlled by the displacement of the constant speed element.

The essential requirements of the fixed and variable displacement elements of this transmission are approached from the standpoint of good dynamic performance and minimum energy dissipation. Parameters are discussed which will serve as figures of merit in the selection of the components which go to make up the transmission. Types of piston pumps and motors are discussed with respect to desired characteristics and optimum parameters.

One of the important factors which is considered in the evaluation of piston pumps and motors for such applications is the dynamic characteristic of the fixed displacement element. Here the interaction of inertia, torque, and velocity are considered in the selection.

Another point of considerable importance is the effort by which the displacement of the variable element is changed. The obvious advantage of only having to supply a low power source for this purpose requires that stroking efforts be small, uniform and with a minimum of dynamic influence.

Other features of the transmission which are considered are the influence of the volume of fluid in the active system attributed to the components themselves, the no-load or standby losses when no fluid is being displaced, the ability of the fixed displacement element to operate at low speeds with a minimum of velocity fluctuation and general effects of volumetric and mechanical inefficiency.

● HYDRAULICS ADD VERSATILITY TO MODERN LIFT TRUCKS

By F. C. Schuster, Chief Engineer, Material Handling Division, The Buda Co., Division of Allis Chalmers Mfg. Co., Harvey, Illinois

The modern lift truck has attained universal recognition by industry because of the advantages gained from proper and varied utilization. In order to achieve this position it was necessary for the lift truck industry to maintain continued aggressiveness throughout a relatively short span of years. Lift truck achievements can be appreciated when one recognizes the facts that lift trucks range in sizes from one to one hundred thousand pounds capacity and several sources of power such as electric, gasoline, diesel and combination gas-electric are available.

The success of lift truck developments has and is in part due to utilization of hydraulics for transmission of power. Hydraulics play a very important part in providing the means to supply the power to elevate, tilt, and even provide the tractive effort required to transport loads. Larger capacity units also are equipped with hydraulic systems which provide the power to steer and brake the vehicles.

The object of every lift truck designer is to develop a unit with greater load carrying capacity and reduced physical size. Compactness of design is highly desired because maneuverability is improved. High pressure hydraulic systems lend themselves in this respect, consequently the lift truck designer is susceptible to higher pressure hydraulic systems. The majority of lift trucks are equipped with hydraulic systems capable of producing and withstanding pressures up to 1500 and 2000 psi; however, some lift trucks are equipped with hydraulic systems which operate efficiently at pressures as high as 3000 psi.

In addition to playing an important part in the primary or basic functions of the modern lift truck, hydraulic power has been utilized in many other ways to provide the motivating force required to actuate the many attachments which have been developed. The vast variety of attachments developed to date offers some idea of what the lift truck industry has accomplished in order to meet industry's requirements. These accomplishments however great do not fulfill all of present day requirements and only represent in a small way the vast requirements for material handling equipment.

Material handling is highly specialized, consequently the lift truck industry must continue to develop

Continued on page 130

Announcing the 1954 Award Winners

The first three prize winning papers which follow represent outstanding examples of design, application and operating techniques of fluid power. Names of all winners of prizes and honorable mention are on following pages. Each entry was individually evaluated on the basis of practicality, economic value, originality and presentation. Judges for the 1954 Prize Paper Contest were D. G. Green, Chief Engineer, Williams, White & Company, F. L. Mackin, Chairman, Machine and Wood Shops and Hydraulics, General Motors Institute and J. T. Marshall, Chief Engineer, Hamilton Division, Bendix Aviation Corporation.

FIRST PRIZE AWARD $500

Walter Stampfl and **Lee Drasin,** Application Engineers, Greer Hydraulics, Inc., Jamaica, New York. For their paper "How to Prevent Hydraulic Shock in Mobile Equipment."

An analysis of the problem of hydraulic shock in mobile equipment and its control by the use of the hydro-pneumatic accumulator. Two case histories are cited.

SECOND PRIZE AWARD $300

Karl Schubert, Design Engineer, National Acme Co., Cleveland, Ohio. For his paper "Oil Controlled Spindle Positioning Attachment."

The design of a hydraulic circuit, with safety interlocks, on a six spindle automatic screw machine. Oil power is used for stopping the spindle in the required position necessary for feeding the work automatically into the adapter of the spindle.

THIRD PRIZE AWARD $200

A. M. Knorr, Tool Engineer, Leeds & Northrup Co., Philadelphia, Pa. For his paper "On Induction Hardening Equipment this Electro-Pneumatic System Meets Work Feed Requirements."

Electrical and pneumatic circuits for the control of mechanical movements of the feeding devices of an induction heating unit cut costs by simplifying tooling, eliminating waste movements and shortening set-up time.

. . . 4th through 7th PRIZES $50 Each

Robert Spurr, Functioneer, Functional Procedures Section, Engineering Department, Canadair Ltd., Montreal, Canada. "Low Pressure Bleeding of Hydraulic Systems."

The author makes a good case for his thesis—low pressure bleeding of hydraulic systems is often more effective than high pressure bleeding. While he uses an aircraft braking system as an illustration, he maintains that low pressure bleeding of any hydraulic system will almost always prove more effective than a high pressure method.

Bruce Barton and **Robert Gignac,** Controls Engineering Section, Hautau Engineering Co., Detroit, Mich. "Conversion of Obsolete Machine Tools to Modern Hydraulic Operation."

Conversion of a 105 inch shear blade grinder to modern hydraulic operation by replacement of inadequate drives and controls with hydraulic power and electric control. The new design gave a 150 percent increase in table speed, variable speed control, smoother, shorter work stroke and more accurate work.

Earl W. Johnson and **Stanley A. Bjorklund,** Development Engineering, Rockford Machine Tool Co., Rockford, Ill. "Form Slotting by Tracer Control."

Design of a hydraulic tracer circuit and its application to a slotter for machining variable internal contours. A standard slotter with longitudinal, cross and rotary power feed and traverse is described with the tracing done in the cross movement.

W. S. Templeton, Assistant Superintendent, Factory Planning Department, Northern Electric Co. Ltd., Montreal, Canada. "High and Low Pressure Hydraulic System for Assembly Operations."

The design of a dual pressure system—5 gpm at 1500-2500 psi to operate clenching tools and one gpm at 1000 psi to operate card wiring and cut-off tools. Equipment selection, operation and maintenance is detailed.

. . . Honorable Mention

Allan Stone, Assistant Chief Engineer, GAR Precision Products, Inc., Stamford, Conn., "The Pin Type Restrictor Valve" • **William L. Carlson, Jr.,** Design Engineer (Electrical), Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., "Closed Systems—Their Design and Control" • **John M. Doyle,** President, Jadco Corp., Painesville, Ohio, "Automatic Hydraulic Grinder" • **Clarence Russell Anderson,** Senior Research Engineer, Bill Jack Scientific Instrument Co., Solana Beach, Calif., "Discharge Tester for Miniature Metering Orifices" • **Frederick J. Shaltz,** Machine and Hydraulic Circuit Designer, AC Spark Plug Division, General Motors Corporation, Flint, Mich., "Special Hydraulic (Oil) Intensifier" • **George Kartman,** Industrial Products Division, Canadian General Electric Co. Ltd., Toronto, Ontario, Canada, "Air Actuated Soldering Machine Speeds Up Production and Gives Better Solder Jobs" • **Milton Adler,** Mechanical Engineer, Brooklyn, N.Y., "Development of a Basic Valve Design" • **Donald L. Kingston,** Design Specialist, Sylvania Electric Products, Inc., Salem, Mass., "Hydraulic Variable Flow Control Valve" • **Gene Roberts,** Engineering Department, Manchester Machine Co., Middleton, Ohio, "Hydraulic Helper Drive Paper Mill Machine."

The first three major prize winning papers are presented on the following pages. These papers illustrate successful applications of fluid power to mobile equipment, machine tools and special in-plant equipment. Other prize winning papers will be published in following issues.

FIRST PRIZE

LEE DRASIN and WALTER STAMPFL

How to prevent

HYDRAULIC SHOCK

on mobile equipment

Don't accept as "normal wear" damage done to bearing parts by shock loading. Shock caused by suddenly stopping a hydraulically powered mass can be greatly reduced and often eliminated.

THE problem of transporting a mass from one point to another causes an interplay of natural forces that result in hydraulic and mechanical shock which is damaging to mobile equipment. The accumulated effects result in premature wear and fatigue of mechanical parts. In the case of a fragile product, physical damage to the materials being transported may occur. Continuous shock fatigues the operator, increasing the risk of accident to himself and the equipment.

Shock results when a mass in motion is stopped suddenly. The time factor involved is short. A hydropneumatic accumulator tee'd into the load supporting pressure manifold decelerates the mass and prevents shock from developing.

Mechanical moving parts in contact with each other in rotary or linear motion will wear at a rate proportional to the friction between the parts. Add shock loading to bearing parts and the friction factor goes up tremendously, thereby greatly affecting the life of the parts themselves. The combined result has been accepted as so-called "normal wear". Fatigue failure of structural members occurs as a result of shock loading. Installation of a hydro-pneumatic accumulator makes it possible to eliminate "load shocks" from the mating parts by absorbing the energy in the compression of the nitrogen gas in the accumulator bag.

To the owner of this equipment, hydraulic shock results in four (4) distinct costs:

1. Operator fatigue reduces work capacity of man and machine.
2. Constant preventive maintenance is a definite expense item.
3. Breakdown repairs involve the costs of parts and labor.
4. Down time of machine and the operator during the period of repairs is often the costliest of all.

Preventive maintenance is a continuous and unavoidable expense. Breakdown repairs and down time of the machine and operator can be reduced to an unbelievably smaller cost item by the proper application of a hydro-pneumatic accumulator.

In a great many field installations and on equipment of many different makes, the accumulator has proven itself a most valuable accessory as a hydro-pneumatic spring. A recent example of accumulator effectiveness was demonstrated on the mobile equipment shown in Figure 1. The vehicle was operated 2300 hours during an 18 month period in connection with an open hearth furnace operation in a steel plant. Traded after 18 months for a new vehicle, it required no new parts which would be considered as normal replacements. The unit was tightened up and placed on show for resale.

FIG. 1. AFTER 18 months of rugged service, this loader did not require parts which would be considered "normal replacement". The accumulator in the hydraulic circuit increased the life of machine members by minimizing shock.

The following examples illustrate the mechanics of applying the accumulator for this application.

CASE NO. 1

Assuming that a materials handling lift truck carrying a load (w) rolls over a curb and drops a height (h) (the curb height) find the deflection (d) of the lift cylinder under the impact of the load. (See Figure 2).

Momentum developed by the truck falling height (h) is equal to (mv) where (m) is the mass of the load and (v) is the velocity obtained in falling through height (h).

Since the fall can be treated as a free fall, velocity $v = \sqrt{2gh}$.

Therefore, Momentum $= mv = m\sqrt{2gh}$ .....(1)

Resistance to the impact is set up by the lift cylinder of Area (A) supported under hydraulic pressure (P). Absorption of the impact is effected by the force (F) of the cylinder (area A times the pressure P) for a period of time (t).

Or Absorption of Impact $= Ft$

Since the momentum is equal and opposite to the Absorption of Impact

$m\sqrt{2gh} = Ft$

or since $F = PA$

$m\sqrt{2gh} = PAt$ .....(2)

The absorption of impact occurring over a period of time (t) may be considered as uniform deceleration of the mass (m) through the cylinder deflection (d).

Or $d = \frac{1}{2}at^2$ .....(3)

where (a) is the decelerating rate

rewriting equation 3

$$t = \sqrt{\frac{2d}{a}} \quad \text{.....(4)}$$

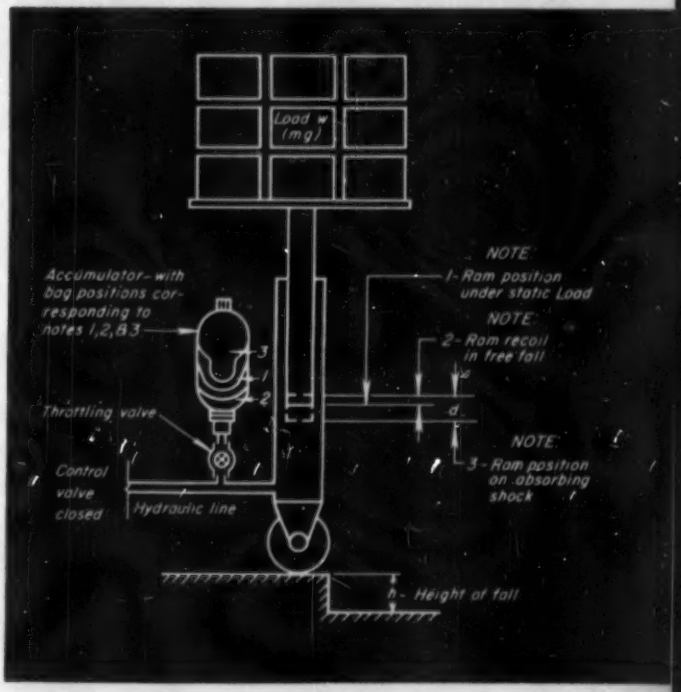


FIG. 2. ILLUSTRATES CASE 1 where a lift truck carrying a load rolls off a curb. The impact causes a deflection of the lift cylinder which causes a volume of oil to be displaced. The accumulator in the system prevents shock by absorbing the energy in the moving volume of oil.

substituting (t) in equation 2
we get

$$m\sqrt{2gh} = PA\sqrt{\frac{2d}{a}} \quad \text{.....(5)}$$

squaring both sides of 5

$$2m^2gh = \frac{2P^2A^2d}{a} \quad \text{.....(6)}$$

rewriting 6

$$d = \frac{m^2ghA}{P^2A^2} \quad \text{.....(7)}$$

The deceleration value (a) is dependent on the hydraulic force (F) and the mass of the load (m).

$F = ma$
and also since $F = PA$

$$a = \frac{PA}{m} \quad \text{.....(8)}$$

substituting 8 in 7
we have

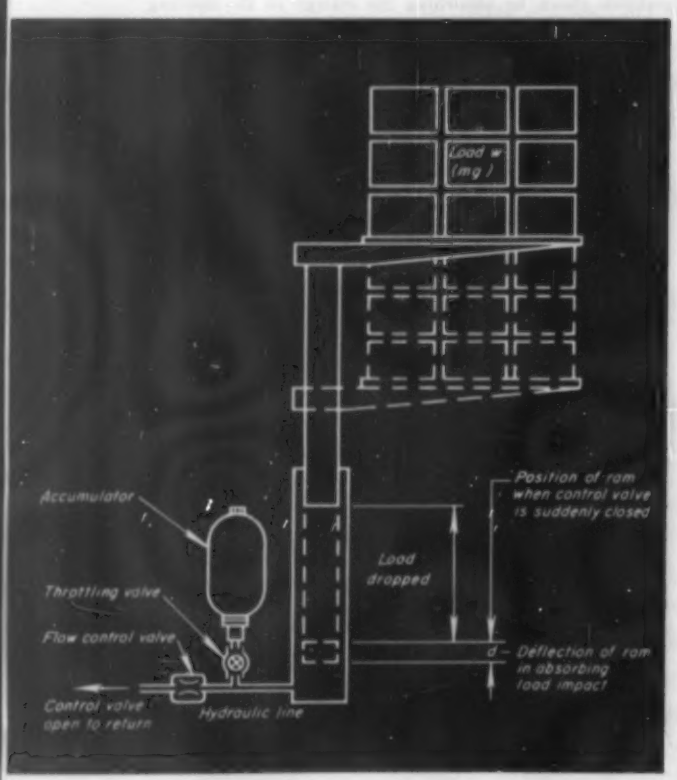
$$d = \frac{m^2ghPA}{P^2A^2m} \quad \text{.....(9)}$$

rewriting

$$d = \frac{mgh}{PA} \quad \text{.....(10)}$$

We recognize (mg) as the load (w) and

$$d = \frac{wh}{PA} \quad \text{.....(11)}$$


Load w (mg)
Position of ram when control valve is suddenly closed
Accumulator
Load dropped
Throttling valve
Flow control valve
d – Deflection of ram in absorbing load impact
Control valve open to return
Hydraulic line

The pressure in the accumulator absorbing the impact will vary with the deflection (d) and because we can set two limits for the pressure in the accumulator between the start and the end of the stroke of the cylinder through deflection (d), we can take the mean of these limits for all practical purposes as the average resisting pressure ($\overline{P}$).

and

$$d = \frac{w\,h}{\overline{P}A} \quad \text{.....(12)}$$

where w = load (lbs)
h = height of fall of truck (inches)
$\overline{P}$ = $\frac{\text{precharge pressure} + \text{maximum psi}}{2}$
A = area of cylinder (sq. in.)

If you like to approach this problem in terms of energy, here is a much quicker evaluation:

Again the truck drops off the curb of height (h). The potential energy ($\overline{P.E._D}$) of the load (w) is (mgh) or (wh). The energy ($\overline{P.E._A}$) in the hydraulic system to absorb the kinetic energy ($\overline{KE_I}$) of impact is equal to the mean accumulator pressure ($\overline{P}$) times the area of the cylinder times the deflection of the cylinder or

$$\overline{P.E._A} = \overline{P}\,A\,d \quad \text{.....(13)}$$

Since the potential energy ($\overline{P.E._D}$) of the load (w) at height (h) = kinetic energy of impact ($\overline{KE_I}$) = energy of absorption ($\overline{P.E._A}$)

$wh = \overline{P}Ad$

or $d = \frac{wh}{\overline{P}A}$

which agrees with equation 12.

Equation 12 is true for a vertical lift truck where the cylinder acts directly against the load.

However, since in most fork type lift trucks the cylinder acts against the load through a chain device having a mechanical advantage of 1:2, the value (w) in the above equation becomes 2 times the load.

The same approach as above may be made to any type of handling equipment—as for example a bucket loader if the component forces and moments are converted to vertical linear forces.

CASE NO. 2

Taking another condition of absorbing the shock of a load (w) dropped from a high to a low position and suddenly stopping the fall by closing the control valve. (See Figure 3).

FIG. 3. ILLUSTRATES CASE 2 where the shock of a dropping load is absorbed by the accumulator. Accumulator size depends on the amount of cylinder deflection. Capacity must be sufficient to provide a cushion for the moving mass of oil.

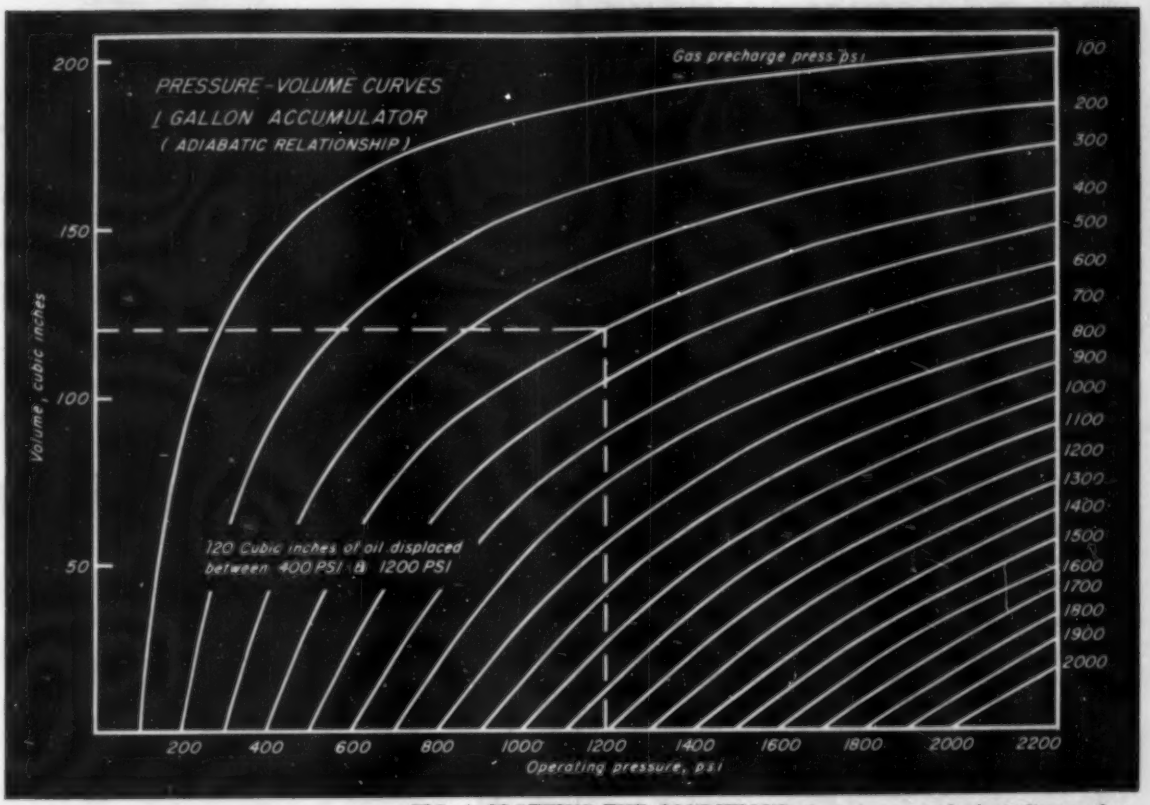


FIG. 4. PLOTTING THE CONDITIONS given in example 1, indicates that this accumulator can absorb 120 cubic inches of oil from the deflecting cylinder when the precharge pressure is 400 psi and the maximum pressure is 1200 psi.

Normally a flow control valve limits the flow from the cylinder and therefore the load will drop with a constant velocity (v) after reaching the falling speed.

Approaching the problem from an energy standpoint

K.E. (of load falling) =
P.E. (of impact absorption) .....(14)

where K.E. $= \frac{1}{2}\ m\ v^2$ or $\frac{1}{2}\ \frac{w}{g}\ v^2$

P.E. $= \overline{P}\ A\ d$ (See Equation 13)

and K. E. = P.E.

therefore $d = \frac{w\ v^2}{2\ g \overline{P} A}$ .....(15)

or converting (15) so that deflection (d) results in inches.

$$d = \frac{6w\ v^2}{g\ \overline{P} A} \quad \text{.....(16)}$$

where w = load (lbs)
v = velocity of fall (ft./Sec.)
g = gravity (32.2 ft./sec.^{2})
A = area of cylinder (in^2)
$\overline{P}$ = mean accumulator pressure (psi)

Knowing the deflection (d) of the cylinder and multiplying this times the area of the cylinder will give the amount of oil displaced from the cylinder to the accumulator. Resorting to the adiabatic curves of the various accumulator sizes will give the accumulator capacity needed.

EXAMPLE (CASE NO. 1): A chain lift fork truck (mechanical advantage ½) with a 6 inch dia cylinder and having a load of 10,000 lbs is dropped off a 4 inch curbing. What will the deflection of the cylinder

About the Authors

Over the past twenty years, Walter Stampfl has gained experience in the hydraulics field as designer, project engineer, and manufacturing manager. At Greer for the past seven years, Stampfl has specialized in accummulator development and application.

Lee Drasin was associated with Greer Hydraulics for ten years, starting as the first employee in their industrial division. While in charge of accumulator manufacture, he made many production and design contributions. He recently joined Unisco, Inc. as sales manager.

be and what size accumulator is needed if the maximum pressure of the system is fixed at a relief valve setting of 1200 psi. A 6 inch dia cylinder has an area of 28.27 sq in and since the cylinder supports a load of 20,000 lbs (mechanical advantage ½), the hydraulic pressure is approximately 700 psi in the state of rest. A precharge pressure of 400 psi is installed in the accumulator.

then: $w = 20{,}000$ lbs

$h = 4$ in

$$\overline{P} = \frac{400 \text{ psi} + 1200 \text{ psi}}{2} = 800 \text{ psi}$$

$$d = \frac{.4 \times 20{,}000^2}{800 \times 28.27} = 3.5 \text{ in deflection of ram.}$$

The cylinder area times the deflection or

$28.27 \text{ in}^2 \times 3.5 \text{ in} = 100 \text{ cu. in. displacement}$

In checking this displacement against the adiabatic pressure volume charts (See Figure 4), it is found that a one gallon accumulator will absorb approximately 120 cu in of oil between a precharge pressure of 400 psi at the 1200 psi maximum pressure given in this example: A one gallon accumulator is ample to handle the load shock in this problem.

EXAMPLE (CASE NO. 2): The lift truck in example 1 suddenly drops its load by opening the control valve and the falling load is suddenly halted. The hydraulic system is fitted with a flow control valve that limits the flow to 90 gpm. What is the cylinder deflection and will the one gallon accumulator be sufficient in capacity to absorb the shock?

Assuming that the load falls through a sufficient distance to reach the velocity limited by the controlled flow rate, then the velocity of the load

$$v = \frac{90 \text{ gal/min} \times 231 \text{ in}^3/\text{gal}}{60 \text{ sec/min} \times 28.27 \text{ in}^2 \times 12 \text{ in/ft}}$$

$v = 1$ ft/sec (approx.)

Applying equation 16

$$d = \frac{6 \times 20{,}000 \text{ lbs} \times (1 \text{ ft/sec})^2}{32.2 \text{ ft/sec} \times 800 \text{ lbs/in}^2 \times 28.27 \text{ in}^2}$$

$d = 0.16$ in

Since the deflection "d" is much less than in example 1, the one gallon accumulator is of sufficient capacity to overcome the shock load in example 2.

In order to simplify the above analysis, the factor of viscous dampening has not been included. This factor does, however, play a part in dampening out load shocks. By including a shut off valve at the accumulator, the additional advantages of viscous dampening can be established by throttling the valve to an optimum setting on any installation. With this effect included in the hydro-pneumatic spring, the cushion (the deflection "d" in the above example) will be less and the accumulator size will be more than ample from the design standpoint.

On the other hand, the amount of cushion may be controlled by increasing or decreasing the precharge pressure in the accumulator. Further, a smaller size accumulator may be considered when a low cushion can be tolerated or be desired. In all there is design flexibility in many directions in the application of the hydro-pneumatic spring.

▶Oil Controlled

MACHINING of the part as shown in Figure 1 on a six spindle automatic screw machine, brought, beside the problem of loading and unloading, that of stopping the spindle in the required position necessary for feeding the workpiece automatically into the adapter of the spindle. The operations such a unit has to fulfill are best explained by what takes place after a whole machine cycle has been completed.

The machine has indexed from pos. 1 to pos. 2:

1. Disconnecting the spindle from the drive shaft by disengaging the spindle drive clutch.
2. Engaging the brake momentarily to stop the spindle from further rotation.
3. Releasing of the brake for connecting the positioning drive.
4. Sliding in of the drive gear from the positioning drive.
5. Turning the spindle in locating position.
6. When spindle is turned in position, the additional drive must be stopped for smooth setting by the locating pin.
7. The locating pin must drop in automatically.
8. Pin must be locked in position by hydraulic pressure.
9. A connected limit switch or hydraulic valve must start the circuit for the loading operation.

SECOND PRIZE

KARL SCHUBERT

Spindle Positioning Attachment

After the loading operation is finished and before the machine is ready for indexing to pos. 3 a hydraulic valve, controlled by the main cam shaft, starts up the following operations in the positioning unit.

10. Release of the locating pin.

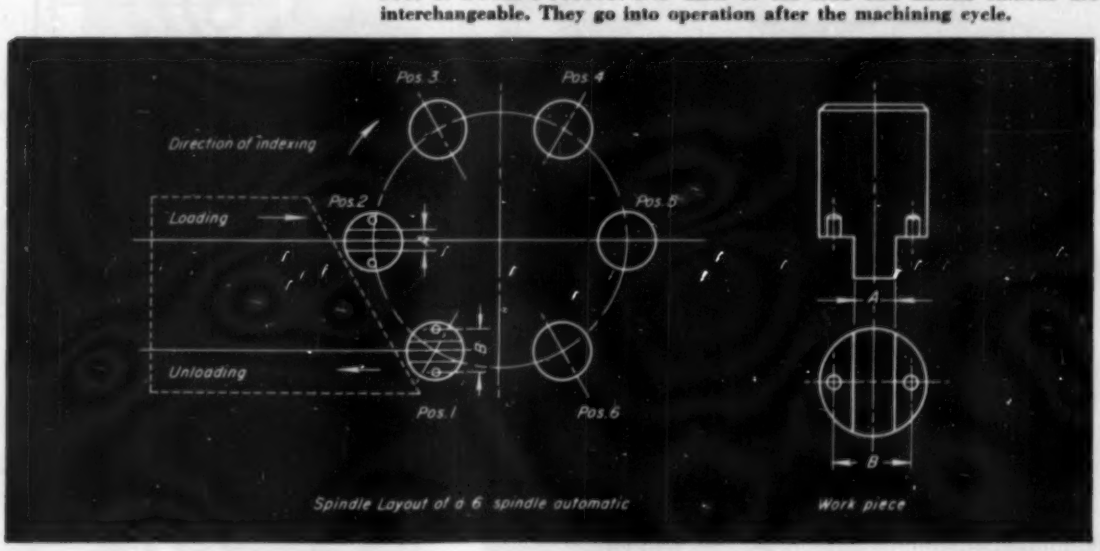
11. Sliding out the drive gear of the positioning drive.

12. Connecting the spindle with the drive shaft by engagement of the spindle drive clutch.

The machine is now ready for indexing which is assured by a limit switch connected with the piston rod of the spindle clutch—and brake cylinder.

The operations Nos. 1-12 are repeated in the unloading position (pos. 1) and therefore both positioning units are alike and interchangeable.

FIG. 1. BOTH POSITIONING units at the load and unload stations are interchangeable. They go into operation after the machining cycle.



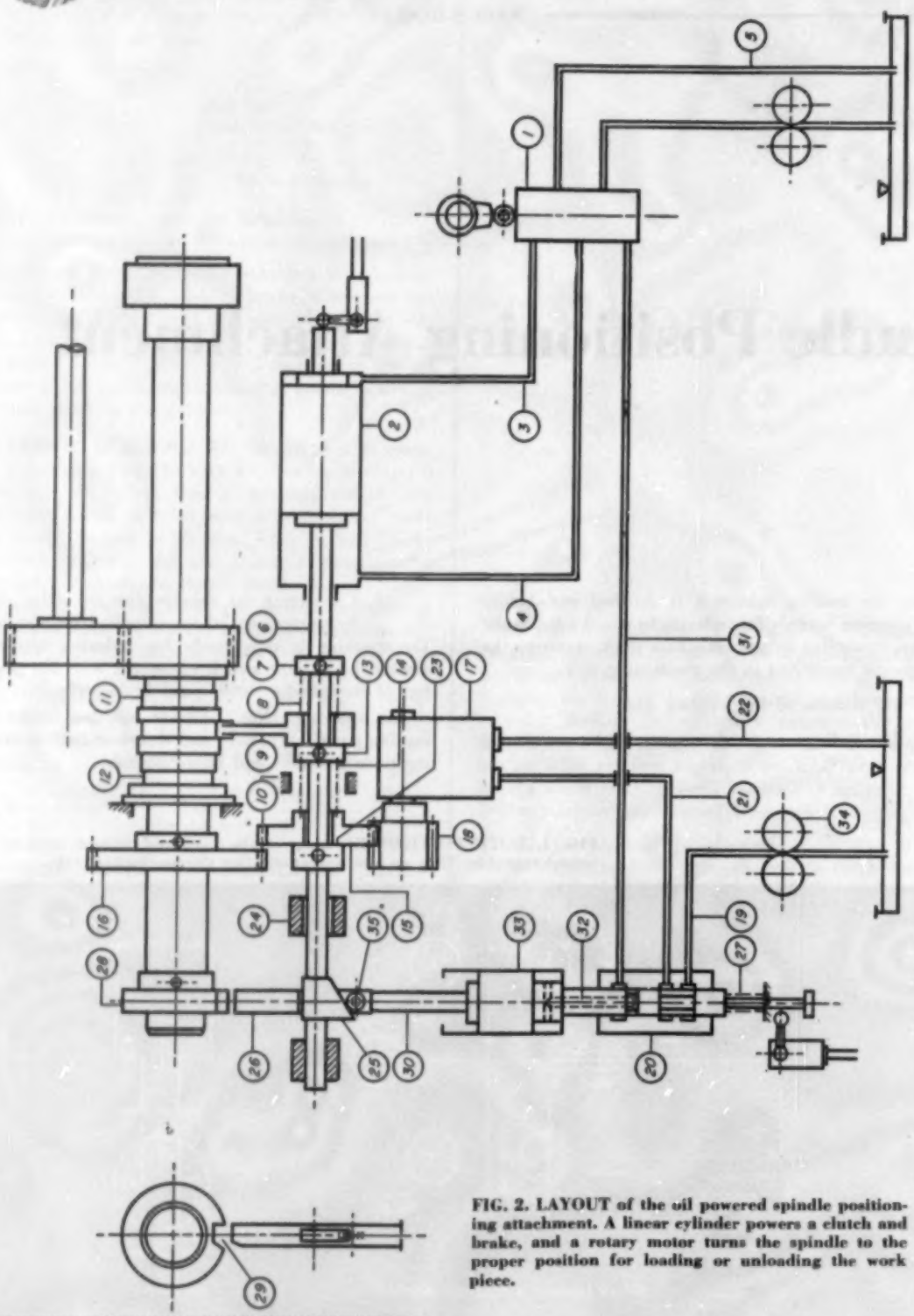


FIG. 2. LAYOUT of the oil powered spindle positioning attachment. A linear cylinder powers a clutch and brake, and a rotary motor turns the spindle to the proper position for loading or unloading the work piece.

HERE'S HOW THE DEVICE OPERATES:

After the machine has indexed from pos. 2 to pos. 3 the cam shaft controlled spindle start and stop valve 1 is in "stop" position. The right side of the clutch- and brake operating cylinder 2 is over pipe 3 connected with the pressure oil of the hydraulic machine circuit. The oil from the left side of the cylinder 2 escapes through pipe 4, valve 1 and pipe 5 to the tank. The piston of cylinder 2 moves to the left side and pushes over piston rod 6, collar 7 and spring 8, the clutch—and brake operating shoe 9 to stop 10. During the operation of shoe 9 the plate clutch 11 is disengaged, the shifter sleeve of the double clutch slides over the neutral position to the brake side 12. The dog lever of the brake side is so designed that the brake is only momentarily engaged and freed when the shoe is stopped at 10 (see Figure 3).

By further movement of the piston rod 6, collar 13 compresses spring 14 and brings the driving gear 15 in mesh with gear 16, which is keyed to the spindle. The hydraulic motor 17 turns the spindle slowly to the locating position through gear 18, 15 and 16. The pressure for the fluid motor is delivered by pump 34 through pipe 19, valve 20 and pipe 21; the oil returns through pipe 22 to the tank. At the same time cam rack 25 releases the locating pin 26 over roller 35. The movement of piston rod 6 is stopped by 23 and guide bush 24. Under influence of spring 27, locating pin 26 rides on the circumference of the locating disc 28 until the pin drops in the positioning slot 29. When this has taken place, the spool in valve 20 moves to stop the oil motor rotation by shutting off pipe 19. At the same time valve 20 connects the oil pressure through 31 and passage 32 with the pressure side of cylinder 33 and the oil locks the pin automatically in position. A limit switch controlled by piston rod 30 energizes the solenoid for starting up the loading circuit. When the loading operation is completed, the cam shaft controlled valve goes to position "start". In this position, lines 3 and 31 are connected with the tank, and line 4 is connected to oil pressure. The piston moves to the right side (start pos.) and unlocks locating pin 26 through cam rack 25 and roller 35. The piston in cylinder 33 pushes the oil through 31 back into the tank. Collar 23 slides gear 15 out of mesh. The pressure connection for the oil motor is opened again (through 19 and 21) and the motor starts spinning for the next positioning operation. As last in the series of operations, collar 13 engages the spindle drive clutch by acting against shoe 9, and the spindle starts turning. A limit switch controlled by piston rod 6 starts up the indexing circuit and the machine can go into the next position.

The mechanical connection between locating pin and clutch operating mechanism gives the security that the spindle drive clutch can be engaged only after the pin is unlocked. If an electrical or hydraulic connection were used it is possible that the failure of a limit switch or valve would upset the sequence of operation. This mechanical control makes use of a very simple hydraulic and electric circuit.

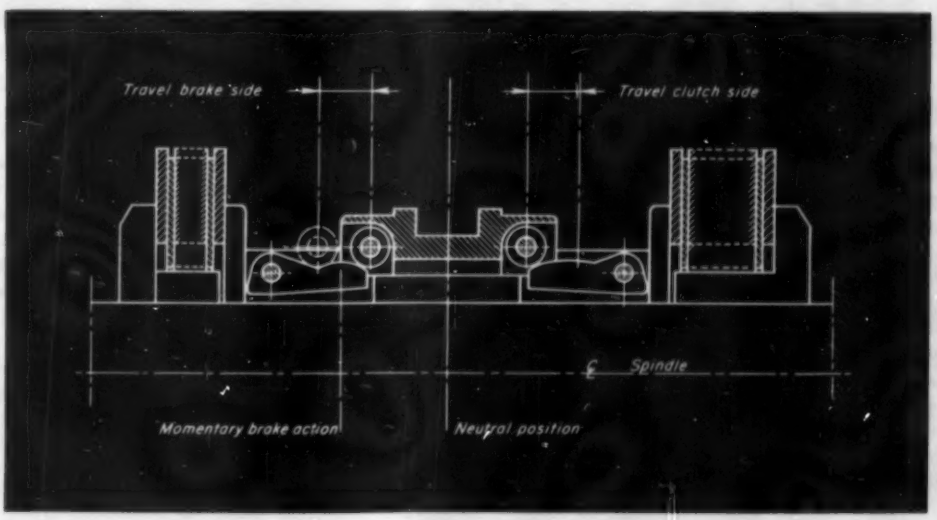


FIG. 3. THIS CROSS-SECTION shows the brake and clutch mechanism in neutral, the spindle drive is disengaged. When the spindle is being driven, the sleeve is moved to the clutch side to hold the clutch engaged. As the shifter sleeve moves to the left, the clutch disengages and the roller acting against the dog lever on the brake side results in momentary brake engagement. Further movement to the left, releases the brake so the spindle is free to be positioned for loading and unloading.

THIRD PRIZE

ATLEE M. KNORR

On induction hardening equipment this . . .

Electro-Pneumatic System

meets work feed requirements

HIGH frequency induction heating as a process finds broad uses in the metal working industry. Basically, induction heating combines three considerations —electrical, metallurgical and mechanical. Although the generation of the heat producing current is an electrical phenomenon, and the metallurgical aspect is important in analyzing results of heating, these factors are secondary to the consideration of production techniques. The productivity of an induction heating unit is determined by the ingenuity of the tooling, which means that the mechanical consideration becomes the most important phase of operation. The electrical and pneumatic circuits described in this article control the mechanical movements of the feeding devices. In addition to this, they serve to simplify tooling making it available at low cost, eliminate wasted movements and shorten set-up times thereby decreasing product cost.

INDUCTION HEATING PRINCIPLES

Induction heating by definition is a means of raising the temperature of metallic parts by the transfer of electrical energy. Operations such as soldering, brazing, hardening, drawing, annealing, tempering and fusing are common.

A high frequency current-carrying conductor, usually referred to as a heating coil, is energized by a power source. The coil sets up a magnetic flux that energizes the metal workpiece in such a way that current is caused to flow around its surface. The resistance of the work to this flow causes an immediate heating action to take place.

A typical heating coil consists of 3/16 in. diameter copper tubing formed into a single loop surrounding the workpiece with a radial clearance of approximately 1/32 in.

THE PROBLEM

The induction heater is controlled from one side by switches, knobs, dials, etc., and operated from an adjacent side—the side on which the heating coil is mounted. A table below the coil or a similar arrangement for supporting work fixtures is usually not supplied. The heating cycle is controlled by a timer and started either by a footswitch or a switch on the panel of the heater.

The problem, therefore, centered around (1) developing a means of supporting work fixtures and subsequently (2) developing a means of feeding parts into (or through) the heating coil, allowing them to remain in the coil for the heating and cooling cycle and then feeding the parts out of the coil.

ANALYSIS

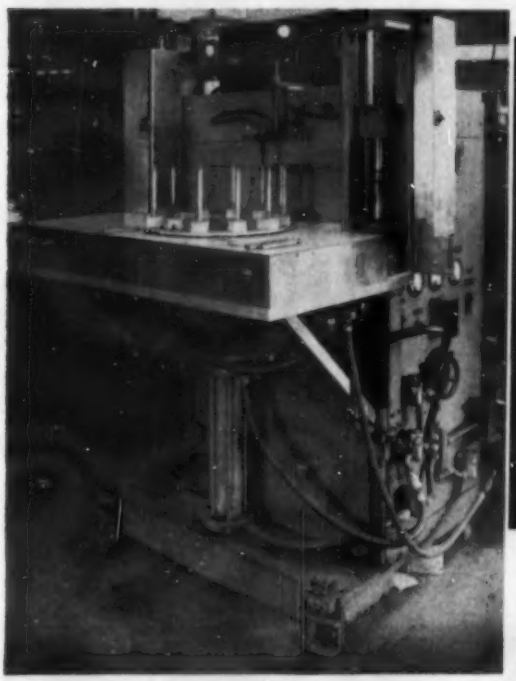
Inasmuch as the majority of operations to be performed were soldering and brazing, it was felt that the operators time to assemble parts, solder and flux would be less than the heating and cooling time and therefore any auxiliary equipment added, need only perform the functions of feeding the assembly into the coil and then away from it. It was not desirable to have an unattended unit and although no means was to be provided for removing finished parts, this was also given to the operator until the condition arose in which the loading and unloading time exceeded the machine time (heating and cooling).

Another factor "steering" the solution was the fact that a large percentage of orders of parts sent to the induction heater were of low quantity. Inexpensive tooling was therefore in order and short set-up times were desirable.

THE SOLUTION

Figure 1 shows the completed unit and illustrates how air played a big part in the final design, although the pneumatic circuit is relatively simple.

An air cylinder is used to raise and lower the table providing the means for feeding parts into the heating coil. An air operated rotary indexing fixture is built into the table, giving an efficient flush mounted appearance and also providing the operator with needed working table area. This is used to rotate parts into position for subsequent entry into the heating coil by the air driven table. Three interchangeable plates can be mounted on the rotary fixture of 6, 12 and 24 working positions respectively. Inasmuch as the rotary fixture can be changed to the different index positions, the three interchangeable plates provide versatility and flexibility in tooling. The warranted tooling expenditure, the quantity of parts per order and the physical size of the parts, determines the station plate to be used.



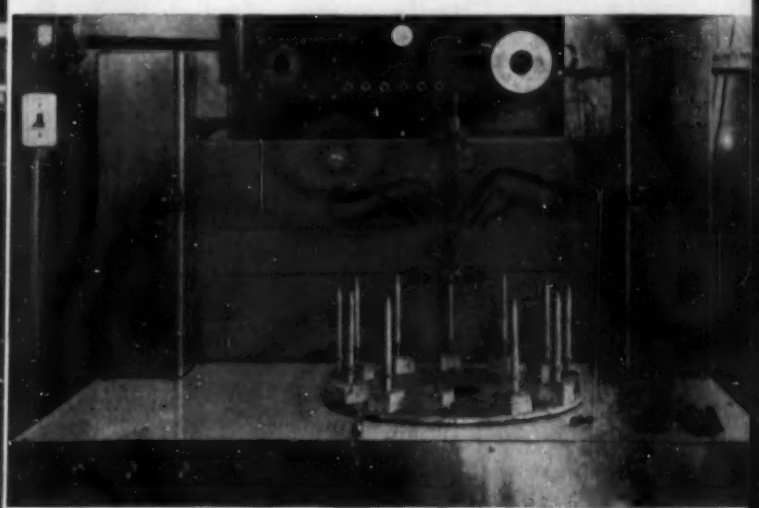


FIG. 1. INDUCTION heating unit showing auxiliary equipment added. Right "safety door" was left open to show construction.

FIG. 2. VIEW OF TABLE, rotary fixture, control box and four table switches. "Continuous operation" or "one cycle" switch starts the unit.

As the parts enter the coil, the coil is energized for a time determined by the setting of one of the two timers built into the equipment. A pressure device can be adjusted directly over the coil for applying pressure while soldering or brazing and maintain pressure until the part is cooled. For this reason a second timer is used to control the length of time the part remains in the coil to adequately cool after the heat has been removed.

The entire unit will perform six basic operations. Four of the six when started, will operate automatically and continuously with only the operator required to load and unload parts. One cycle operation can be obtained for the remaining two operations in addition to the four already mentioned. The six operations are referred to as Set-ups A, B, C, D, E and F and can

be briefly described as follows:

Set-up A—Move switch to start. Table starts to rise. Rotary fixture indexes. Table stops with part in coil and pressure device holding part. Heat starts and continues a pre-set time. Heat stops. Part remains in coil with pressure applied a pre-set time. Table lowers and comes to rest. If "Continuous Operation" switch had been thrown to start cycle, table will start to rise beginning second cycle. If "One Cycle" switch had been thrown to start cycle, it would be necessary to depress the switch again to start the second cycle.

Set-up B—Move switch to start. Table starts to rise. Table stops with part in coil and pressure device holding part. Heat starts and continues a pre-set time. Heat stops. Part remains in coil with pressure applied a pre-set time. Table lowers and comes to rest. The "Continuous Operation" switch is designed to have no effect and only the "One Cycle" switch will start the cycle. This set-up is useful for very low quantity orders where only one station is desirable. Continuous operation is not used in this set-up as an expensive coil could be ruined if the operator should experience difficulty in loading or unloading parts.

Set-up C—Move switch to start. Rotary fixture indexes part into the heating coil. Heat starts and continues a pre-set time. Heat stops. If "Continuous Operation" switch had been thrown to start cycle, rotary fixture will index beginning second cycle. If "One Cycle" switch had been thrown to start cycle, it would be necessary to depress the switch again to start the second cycle. This set-up is useful if the heating coil does not have to completely surround the workpiece and the part can enter the coil from the side.

Set-up D, E and F—These set-ups are similar to set-ups A, B and C respectively, except the heat to the coil is continuously on and not controlled by a timer. Set-ups D, E and F are useful where the heating time is very short, and it is not practical to open and close the induction heater circuit a great many times in succession.

DETAILS OF CONSTRUCTION

Vertical movement of the table can be adjusted to strokes of 0 to 12 inches anywhere within the range. Collars on the side guide posts restrict the upward movement of the table. Holes spaced one inch apart in the guide posts provide a rough adjustment for the collars, while a thread adjustment of the collar itself provides a fine adjustment within the one inch range. A collar on the air cylinder restricts the downward movement of the table.

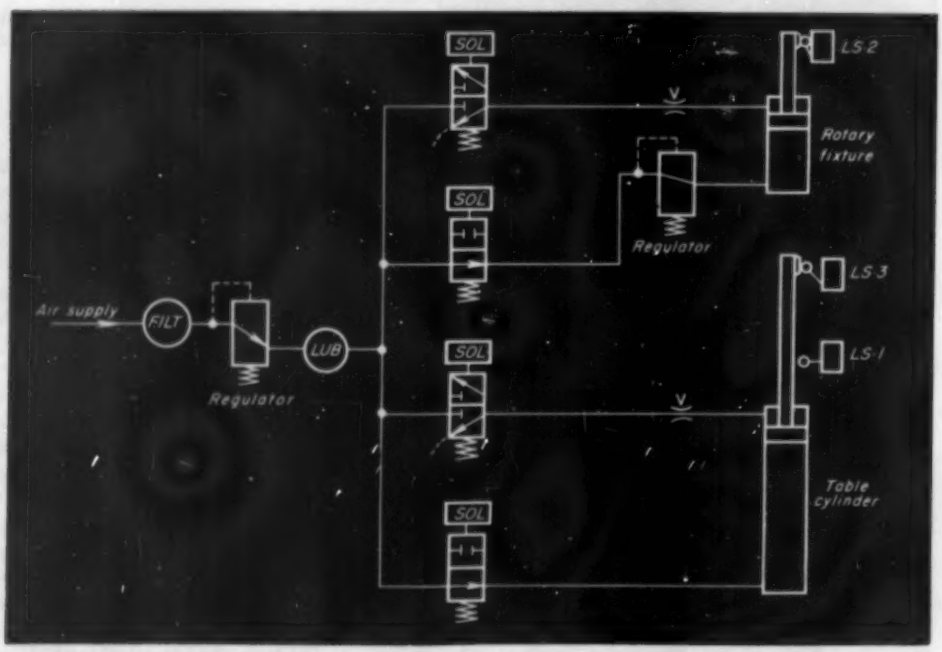
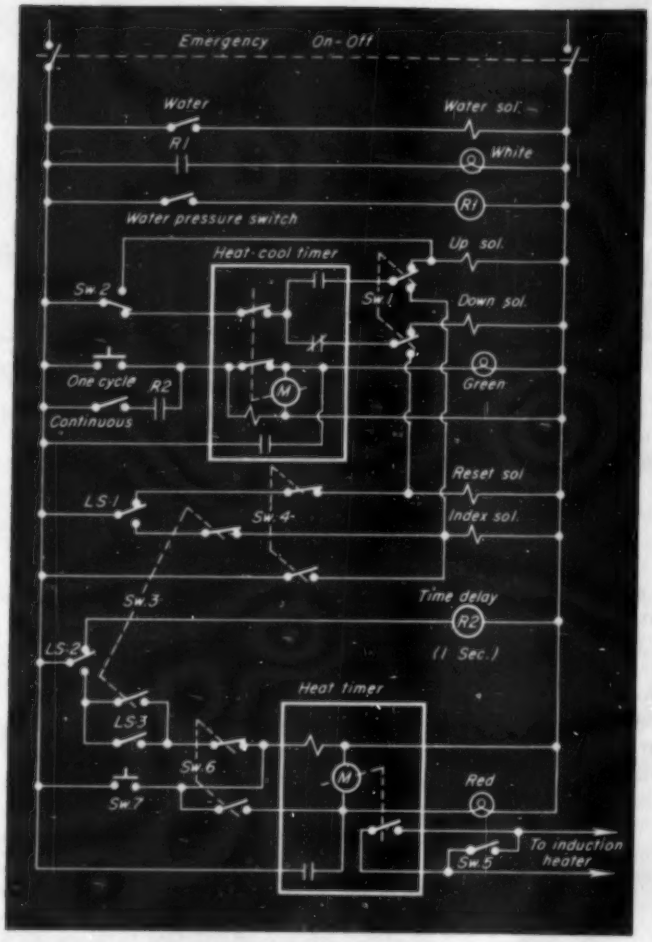


FIG. 3. THE PNEUMATIC equipment provides the mechanical movements of the feeding devices.



SEQUENCE FOR SET-UP A

1—"Emergency" switch is on. "Reset" solenoid and "Down" solenoid are energized. "Water" switch is on. "Water" solenoid is energized. Normal water pressure leaves "Water Pressure" switch open and relay R1 deenergized. Relay R2 is energized through limit switch LS2.

2—"Continuous" switch is thrown starting "Heat-Cool Timer". "Up" solenoid is energized immediately and "Down" solenoid is deenergized. Table starts moving upward.

3—A short distance off the bottom, one of the rods under the table moves away from limit switch LS1. The index solenoid is energized and the rotary fixture moves the next work-piece into position.

4—The movement of the rotary fixture actuates limit switch LS2 dropping out relay R2.

5—As the table nears the top of its stroke (1/16" away), limit switch LS3 is closed by the other rod beneath the table, starting the "Heat Timer".

6—The "Heat Timer" is the first to time out followed by the "Heat-Cool Timer". The "Down" solenoid is energized and the "Up" solenoid is deenergized. The table moves downward.

7—Limit switch LS3 opens with no effect.

8—Limit switch LS1 is actuated as the table nears the bottom. This deenergizes the "Index" solenoid and energizes the "Reset" solenoid. The rotary fixture does not move when this takes place, however, limit switch LS2 is actuated and relay R2 pulls in after a one second time delay.

9—As the "Continuous" switch is closed, contact R2 starts the "Heat-Cool Timer" for the second cycle.

FIG. 4. SWITCHES shown in set-up A position. "Continuous" or "one cycle" switch will start the machine.

The rotary fixture is adjustable for 6, 12 or 24 positions by removing the top plate and inserting the proper "pawl baffle plate" as supplied by the manufacturer of the device.

Two rods beneath the table actuate limit switches which control the movement of the rotary fixture and start the heating cycle. In set-ups where the table is moving vertically the rotary fixture limit switch (LS1) is adjusted to be actuated just as the table starts moving upward. The heat timer limit switch (LS3) is adjusted to be actuated just as the table reaches its top position. In set-ups where the table is not moving (C and F) the rods are moved away from the limit switches.

The timer on the right of the control box labeled "Heat Time" controls the time of the heating cycle. The red pilot light on the right of the control box indicates the timer is in operation and the heating coil is carrying current. For set-ups D, E and F this timer is not used as the heat is applied continuously.

The timer on the left of the control box labeled "Heat and Cool Time" controls the time the entire unit takes to complete one cycle with one exception. This time includes the time it takes for (1) the table to rise, (2) the heating cycle, and (3) the part to remain in the coil to cool. Since (1) can be considered fairly constant and (2) is controlled by the "Heat Timer", the effect of changing the "Heat and Cool Timer" is to allow the part to remain in the coil for cooling a shorter or longer period of time. The part of the cycle not embraced by the "Heat and Cool Timer" is the time required to lower the table. The green pilot light on the left of the control box indicates the timer is in operation.

The seven switches on the control box are used in selecting the desired set-up. By consulting the engraved plate below the switches the position of the switches can be determined for a specific set-up. For example—set-up E would require switches 1, 2, 3 and 6 be thrown to the top and switches 4 and 5 be thrown to the bottom.

Switches 1 to 7 are also used in setting up. No. 2 switch can be used to raise and lower the table manually. With the switch thrown to the bottom, the table

will rise. When the switch is returned to the top, the table will lower. The normal position of the switch is always in the top position.

Switch 4 will index the rotary fixture manually. The fixture will index each time the switch is thrown to the bottom position and must be returned to the top position for a subsequent index. The rotary fixture is locked with switch 4 in the bottom position for set-ups B and E.

Switch 6 is used to set-up switch 7 as the means of starting the heat timer. This is used mainly in trying out a new job in determining the exact heating time required. Switch 5 will heat the coil for whatever length of time the switch is left in the bottom position.

The four switches on the front of the table and to the operators left are used most frequently. The switch nearest the left is the line switch for the auxiliary equipment, however, it is labeled "Emergency" inasmuch as it will stop all movements if something should go wrong. The second switch from the left controls the supply of water to the heating coil. Water must be circulated through the coil to prevent damage by radiation. The purpose of the switch is to make it more convenient for the operator when changing coils, than operating the water valve supplied. The "Continuous" switch and the "One Cycle" switch are the other two switches mounted on the table and their operation has been described previously.

The white pilot light in the center of the control box is an indication of low water pressure. Because of the necessity of circulating water through the heating coil for cooling, low water pressure may ruin an expensive coil. The induction heater, therefore, shuts off when a low pressure condition arises and the white pilot light is an indication to the operator that the part in the coil may not be heated properly.

PNEUMATIC CIRCUIT

The air diagram is shown in Figure 3 and is self explanatory. The air supply of 60 psi is fed through an on-off valve and then through a filter, regulator, gage and lubricator. From a five way manifold the air is fed to four three way solenoid operated valves. Two valves control the cylinder that raises and lowers the table and two valves control the rotary fixture. (Two valves were used in each application instead of one four way valve, for no better reason than they were carried in stock). An additional regulator was added to the rotary fixture because of the different pressures required for the cylinder and indexing table. Speed control valves are used at the exhaust ports of each air cylinder.

ELECTRICAL CIRCUIT

The electrical circuit is straight forward with the exception of the explanation of the time delay relay R2 which follows.

When the "Heat-Cool Timer" has "timed out" and the table lowers, limit switch LS2 is thrown energizing relay R2 for a subsequent cycle. If the stroke of the table is short, it is possible for relay R2 to "pull in" before the "Heat-Cool Timer" has properly reset itself. A one second time delay before contact R2 closes eliminates this possibility of error which would have resulted in an incorrect timing by the timer.

The sequence of the electrical circuit as it would occur when performing set-up A, continuously, is given with the circuit, Figure 4. This set-up is shown because the others are more or less parts of set-up A and their sequence can be derived from the one shown.

Judges Comments About Prize Papers

"It is obvious from the quality, effort, and ingenuity in the application of hydraulics to power machinery in these prize papers, that not only is there a continual spreading interest in this fast moving field, but a great deal of intelligent and practical talent has already been revealed. It has been a pleasure to have had the privilege to be closely connected with this progress of the hydraulic engineer and with what he has taught me through these papers."

John T. Marshall
Chief Engineer
Bendix Aviation Corporation, Hamilton Div.

"Judging these papers was a very interesting assignment, and I think all the contestants should be complimented for their efforts. APPLIED HYDRAULICS should be commended for making the competition available."

D. F. Green
Chief Engineer
Williams-White & Co.

"I was greatly impressed by the wide applications of both hydraulics and pneumatics. The application of this type of power is growing steadily in all of our industries. The different approaches to the applications leads me to believe there is room for developing some definite principles of hydraulic machine design to be used as a basis."

F. L. Mackin
Chairman, Machine and Wood Shops and Hydraulics
General Motors Institute

BACK PRESSURE

. . . how it affects valve operation

● By John J. Pippenger

BACK pressure as a term is about as misunderstood as any of the idioms that have grown up in the hydraulic glossary. Often it is recognized as something good. In other cases, back pressure is considered as a necessary evil.

Taking the common lever operated valve as a guinea pig we can follow the flow passage and pick out the back pressure factors. As the oil enters in the normal pressure inlet port, it is directed in most cases on a sharp angle to one of the cylinder port connections. This change in direction of oil flow means that there will be a certain pressure drop as long as there is a flow of oil. The oil returning from the opposite end of the cylinder or motor will enter the valve through the other cylinder port and be directed to the tank connection. Again there will be a pressure drop. The devious path from the tank connection to the reservoir may be involved in "tee" connections, elbows, flows from other valves, and in some cases head pressures from overhead tanks. Each pressure drop involved from the entry of the oil from the cylinder into the directional control valve cancels out some of the working ability of the cylinders. This is rather basic and indicates that horsepower is expended in returning the oil from the working mechanism to the reservoir.

PROPER TANK LINES

To minimize power loss or pressure drop caused by restricted lines, tank lines should be adequately sized and properly positioned. This, however, is a small facet of the problem. It is usually possible to use the least expensive piping for the tank and drain connections. In the case of tubing, it is generally only necessary to have sufficient wall thickness to avoid mechanical damage.

Recognizing the human element in fabricating power units, there is a tendency to use the same heavy wall pipe and tubing on the tank ports as that used on the high pressure lines. The reasoning is sound because it could be very expensive to accidentally put thin wall tubing on a high pressure line; and in some cases it could be extremely dangerous. If heavy piping throughout the system is required, consideration should be given to increasing the sizes of the discharge lines from the directional control valves to the reservoir.

CONTROL VALVE DESIGN

Another facet of this subject is the construction of the directional control valves. Many of the newer type valves are constructed with external drains for the valve seals. When there are external drains for the seals, the main tank connection is usually good for the rated overall capacity of the valve. The standard solenoid controlled, pilot operated four-way valve illustrates this point. In this type valve the pilot section has an independent drain and the integral pilot circuit is such that the pressures applied to the various ports of the main portion of the valve are not important as long as they stay within the overall rating.

Back pressure is the key to service life on many seals. The average valve is adequately sealed for its intended service. In many cases "intended service" is not too well understood. A big percentage of mechanical seals are intended for a nominal pressure of about 5 psi. Variations in design can change this valve from ounces up to almost full line pressure, ac-

JOHN J. PIPPENGER, Vice President, Double A Products Co., Manchester, Michigan

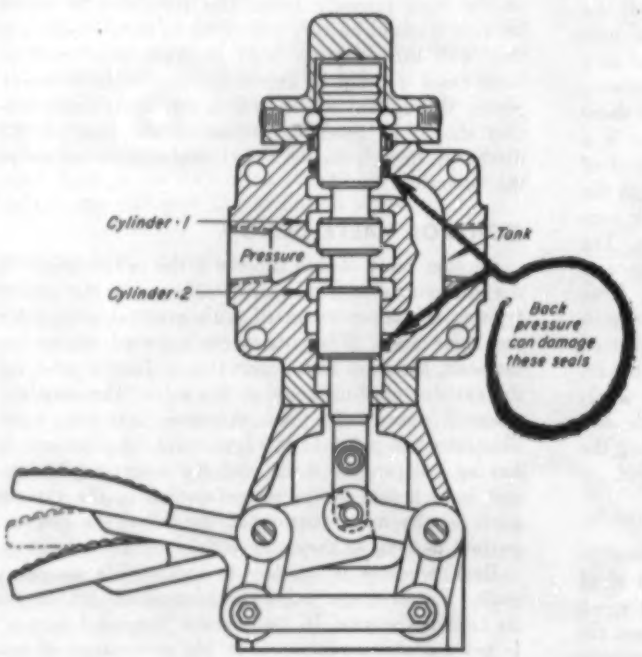
cording to the amount of frictional resistance that can be tolerated. The average solenoid valve is designed for a minimum frictional resistance on the seals. Frictional resistance at the seals used on manually operated spring centered valves must be limited to a valve which permits the use of optimum size springs to insure proper centering. Valves with detent or holding devices are not near as critical relative to the frictional drag of the seals. Assuming that the mechanical seals are properly installed, a certain amount of frictional resistance will be encountered which will be balanced by adequate springs or other devices, so that the valve operates in a normal manner. If, however, the back pressure is increased beyond normal limits on the seals, there will be several types of malfunctioning. The most obvious is the collet grip effect. This is caused by effective pressure on the seal forcing the lip against the spool so that it cannot be readily moved, either manually or with mechanical devices. In the case of an "O" ring, the pressure will expand the rubber in the contained pocket so that it also causes a collect grip effect. The second factor is actual damage to the seal by extrusion, or causing very rapid wear due to increased abrading action.

Many valves are designed so that the seals are ported directly into the tank passages. This affords relatively inexpensive construction and is desirable wherever possible because separate drain lines are avoided. However, the back pressure at the tank port must be held to a value which will cause very little leakage, and no damage or rapid wearing of the seal.

EFFECT OF DIFFERENTIAL AREAS

Under certain quite common operating conditions, the fact that most directional valves have the tank ports the same size as the cylinder and pressure ports greatly contributes to increased back pressure. With the tank connected to the seal pockets, there is a source of trouble when cylinders are used which have larger than normal rod diameters. Take as an example a 2:1 type cylinder where the rod area is approximately one half the piston area. Twice as much oil flows to the head end to move the piston out as that required to bring it back. This large amount of oil required to take the cylinder out will have to be returned to the tank on the back stroke. Looking further into this example, we can assume that an 18 gpm pump and a ¾ inch valve operate the cylinder, which would sound correct under normal circumstances. The fallacy is that the 18 gpm on the head end would go forward and force 9 gpm out of the rod end through the valve; and when reversed, the rod end being fed at

Internally Drained Valve



Normal tank port and a seal drain are combined in this directional control valve. The "O" rings which function as a seal are subject to any pressure that is exerted on the normal tank port. This factor means that as the pressure on the tank port increases it has a tendency to cause the "O" rings to squeeze tighter onto the spool with a collet like effect. With pressures of 100 psi or less, this effect is negligible. Above this value it becomes increasingly difficult to operate the lever. In the detent models this is not too important because a large force is available to operate the spool. In the spring operated models excessive back pressure can cause the packing squeeze to become high enough to overcome spring force and prevent the spool from moving back to its rest position.

the rate of 18 gpm, would force 36 gpm out of the head end. This 36 gpm would be twice the rated flow that the ¾ inch valve is intended to handle, and the seals would undoubtedly cause malfunctioning—either by seizing the spool or leaking or rapidly wearing out. In this particular case, there would be no seal difficulties if they were externally drained through independent lines to the reservoir.

While thinking about back pressure, it might be wise to consider spool balance briefly. Most hydraulic valves are fitted with balanced spools. There are a large number of valve designs which have fully balanced porting at the pressure inlet and around the cylinder ports, but the tank ports are often not balanced. By not being balanced, we mean that both ends are not the same diameter or do not displace the same amount of oil. In the case of the manual valve, we may have a stem coming out of one end and the other end being contained fully in the cap with the cap drained into the tank connection. This same type of construction is used in many varieties of single solenoid operated valves, especially in the small sizes.

In the case of the manual valve, an excessive back pressure will actually shift the valve spool just as if the spool were a small ram. In the case of the solenoid operated valve, we often find that solenoids fail because of the excessive power required to displace this oil against the back pressure.

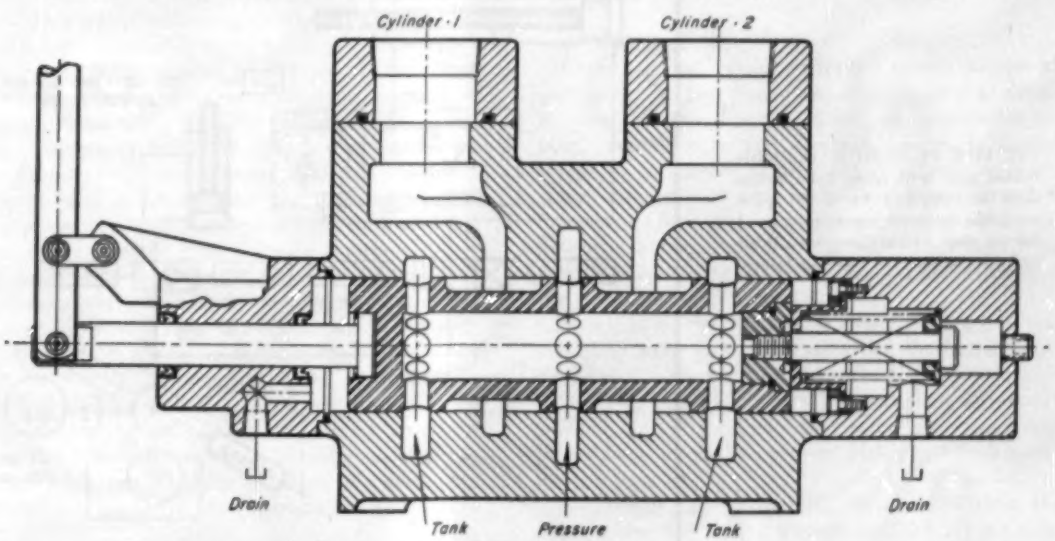
Another good example of the effects of excessive back pressure can be noticed when an open center valve is used with a horizontal cylinder with a light loading. If the exhaust passage is restricted, creating back pressure and all of the ports are connected together in the neutral position, we find that the cylinder creeps forward on the differential area. In some cases, it will operate very rapidly.

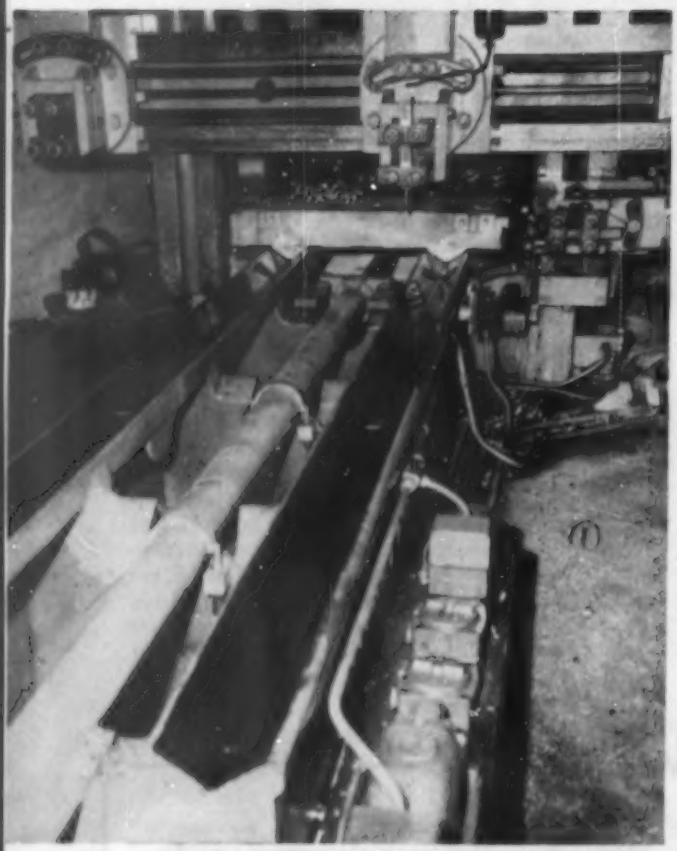
There are the obvious places where back pressure is desirable, such as, holding oil in the lines by restrictive devices for piloting purposes, or placing valves in an exhaust port to insure smooth operation of a power device at a uniform speed and for various sequencing circuits.

The common relief valve is in a sense a pressure controlling device which in many designs relies heavily on back pressures of various sorts, but it too has difficulties with the wrong kinds of back pressures. Normally these valves are internally drained. In the event there is excessive restriction in the tank lines, we find that pressure adjustments become erratic. The reason being that the restriction adds to the value of the springs in the direct spring loaded type, and in the case of the pilot type relief valve the same conditions can exist on a smaller scale because the ratios are not as large.

Externally Drained Valve

Separate connections for the normal tank port and seal drains are designed in this valve. There is a mechanical seal on the portion of the valve that extends out to the atmosphere which is only subject to the pressure on the seal drain connection. The pressure must be proportionate to the values of the sealing mechanism's holding power. For a lip type seal, the back pressure should not exceed five to ten psi, depending on the mechanical details of the seal. The normal spring pocket end of the valve spool must also be drained with a minimum of back pressure to prevent movement of the spool because of the differential area caused by the stem extension, assuming that the two drains are tied together or have equal tank pressures. With the independent external drains, the main tank port can have any pressure exerted on it within the rating of the valve. If the valves are to be connected in series, then it is essential that the tank port be capable of handling full line pressure.





CUTTING SPEEDS from a few ipm to 80 fpm are provided by the oil hydraulic system on this 12 foot planer.

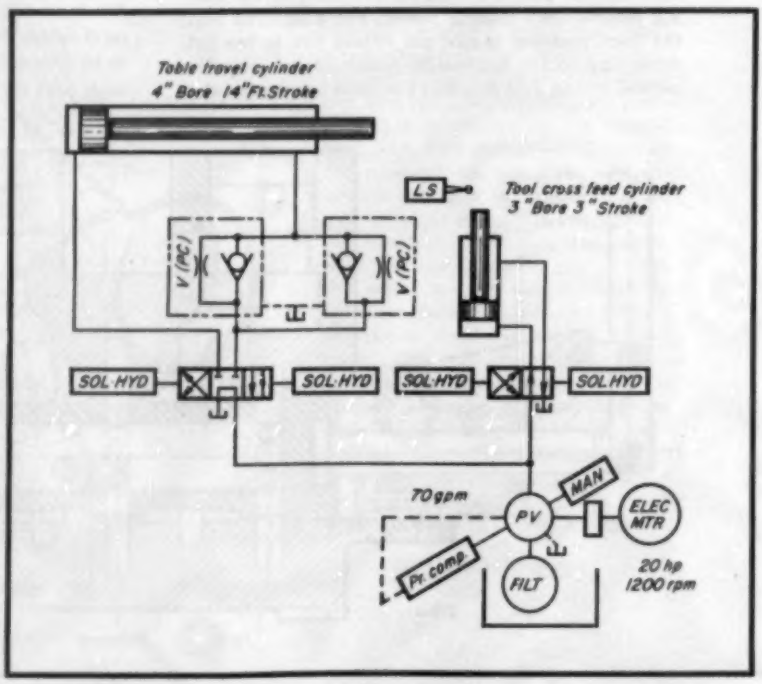
How to Change a

● By William J. Endicott

"We wanted smoother action, increased accuracy, quieter performance and faster work speeds. We got all this with an investment of about $2800 for parts and 450 manhours of labor."

ON a 12 foot planer at Craig Machine, Inc., we replaced the mechanical drive for the table and head feeds with oil cylinders. The changeover has resulted in a machine which gives us better control of surface finish because of the smooth motion provided by oil power and the available stepless range of table speeds. Table speed was increased from 40 fpm to 0 to 80

OIL FOR POWERING the table travel and tool cross feed cylinders is supplied by a 70 gpm variable volume vane pump. A meter out circuit on the table cylinder regulates cutting speed.



Geared Planer Drive to OIL POWER

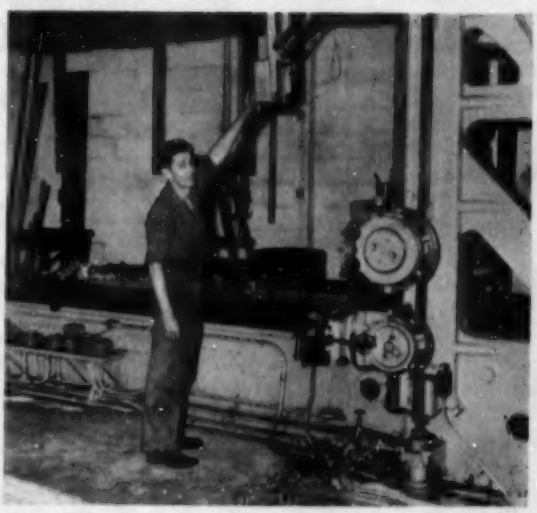
fpm. Machine control is simple and tool life has increased.

To assist us in the selection of the hydraulic power and control circuits, we called on John Gosbee of the Robert R. Pedgers Company, Beverly, Mass. Because of limited requirements, the circuit is quite simple. For the table travel circuit, there is no need to arrange a circuit which will provide both rapid traverse and feed on the cutting stroke. Because dogs on the table can be adjusted to trip the electrical reversing switch so that the tool is "cutting a minimum of air", the table only moves at the set cutting speed in one direction and full speed in the rapid return direction.

The biggest job of the conversion was the installation of the 14 foot stroke table cylinder. It was necessary to lift the table off the ways and then torch cut the webs of the bed casting to nest the cylinder. Three mounting brackets rigidly support the cylinder. Head feeds are controlled by the ratchet and pawl which was used on the original setup. The 3 inch bore, 3 inch stroke oil cylinder was added to power the feed.

Power for the hydraulic cylinders is supplied by a 70 gpm variable volume vane pump set for maximum delivery of 50 gpm, and driven by a 20 hp electric motor. This pump includes a volume adjustment handle and a pressure adjustment screw which automatically controls the amount of oil delivered to the system at the set pressure. Maximum working pressure of this pump is 1000 psi. Working pressure on the planer is set considerably lower. At 500 psi, the 4 inch bore table cylinder will exert greater than a 3 ton force. No relief valve is needed since the pressure compensating governor automatically regulates the maximum pressure and provides over pressure protection.

To handle the feed control, two 3/8 inch pressure compensated valves meter out the flow of oil from the rod end of the table cylinder. Each valve has a stepless adjustable flow rate up to 11 gpm. With the two valves in parallel, adjustment up to approximately 22 gpm is possible. Table speeds provided are 0 to 80 fpm on the cutting stroke and 160 fpm on the return stroke. The table cylinder has a 2:1 differential piston rod. The table can be throttled down to a feed of a few inches per minute to allow applications which were impossible with the old drive.



ALL CONTROL VALVES are conveniently mounted on a bracket which is attached to the side of the planer bed. The original ratchet and pawl mechanism on the cross feed is powered by the cylinder seen at the base of the planer cross-head.

Careful layout of the hydraulic system locates all components so that piping and adjustment is as simple as possible. The power package, which includes the tank, pump, motor and pressure gauges, is located separately at the side of the machine. The four control valves are grouped on a panel which is fastened to the planer bed. Pressure and tank lines from the power package are piped to the panel. Four lines from the valve panel connect to the head and rod ends of the two working cylinders.

Shock at the ends of table cylinder travel is prevented by having special porting and chokes built into the directional control valve which act to throttle the shifting of the valve spool. Special long adjustable cushions in each cylinder cap safely stop the heavy planer table when the operator wishes to "dead-head" it for setting-up.

Electrically, the rebuilding involved wiring the pump motor and wiring a control circuit for the solenoid valves. At the operator's control panel, there are

WILLIAM J. ENDICOTT, assistant production manager, Craig Machine, Inc., Danvers, Mass.

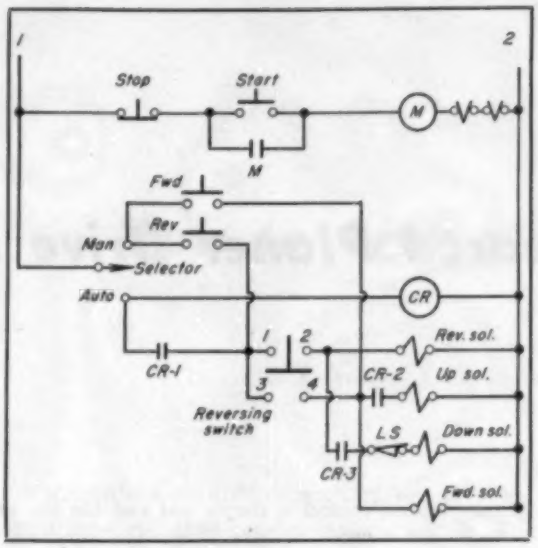
a start and stop button for the pump motor, a selector switch for automatic or manual control of the feed circuits, and forward and reverse buttons to be used when the selector valve is in manual position.

SINGLE RELAY CONTROL

One control relay with 3 normally open contacts, a limit switch and a reversing switch control the automatic cycle. The reversing switch is tripped by dogs on the planer table at the end of each forward and return stroke. When the selector switch is in the automatic position, the control relay is held energized and all its contacts are closed. With the table moving forward, contacts 3-4 of the reversing switch are closed. The "up" solenoid of the tool cross feed valve and the "forward" solenoid of the table travel valve are energized. At the end of the forward stroke the reversing switch is tripped, opening contacts 3-4 and closing 1.2, "up" and "forward" solenoids are deenergized and the table "reverse" and tool cross feed "down" solenoids are energized. The limit switch in the "down" solenoid circuit trips open after the tool has fed in the proper amount.

With the selector switch on automatic the traversing and tool feed cycle keeps repeating. When setup for manual operation, pushbuttons control forward and reverse motion of the table. The planer table can be inched in either direction with the manual push buttons. Since the control relay is not energized, contacts CR-2 and CR-3 are open to make it impossible to energize the tool cross feed solenoids. Cross feed is then obtained by turning the feed mechanism by hand.

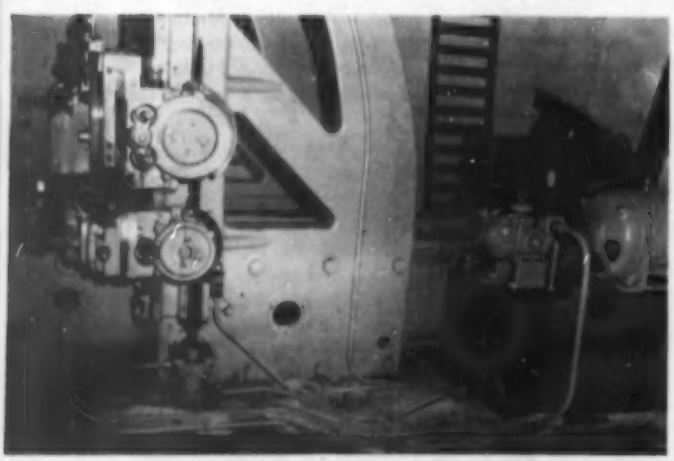
Cost of materials for the conversion which provides us with an efficient machine tool was under $2800.



ONE CONTROL RELAY, a reversing switch which is tripped by table dogs, and a limit switch tripped by the cross feed cylinder, maintain the automatic cycle.

RIGID MOUNTING of the 14 foot stroke table travel cylinder is provided. The planer bed is cut to nest the cylinder. Steel straps lock the cylinder at 3 points along its length.

POWER is supplied by the pump and tank unit located alongside the machine. Pressure and return lines are piped to the valve panel.



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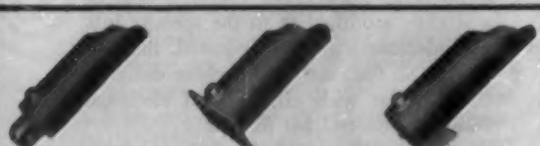
single acting heavy duty cylinders rod plunger construction—capacity up to 2½ tons, sleeve plunger construction—capacity to 24 tons five types of mountings available

double acting heavy duty cylinders capacity push stroke 1½ to 28 tons capacity pull stroke 1 to 25 tons six types of mountings available

telescopic heavy duty cylinders multiple sleeve construction—low shut height with stroke up to 84" plain or pineye mountings—capacity push stroke up to 18 tons

plain threaded pineye

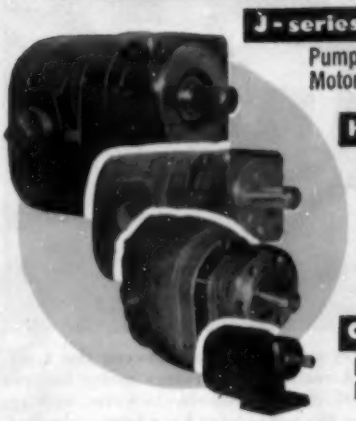
PISTON ROD FITTINGS



pineye base foot

CYLINDER MOUNTINGS

OIL HYDRAULIC PUMPS - MOTORS



J - series
Pumps— 5 sizes - 50 to 100 g.p.m.
Motors— 5 sizes - 18 to 35 h.p.

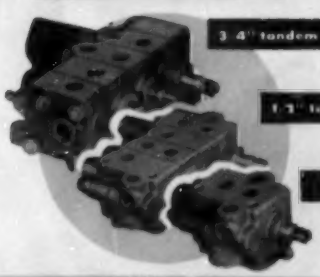
H - series
Pumps— 5 sizes - 12 to 42 g.p.m.
Motors— 5 sizes - 6 to 16 h.p.

D - series
Pumps— 4 sizes - 12 to 30 g.p.m.
Motors— 5 sizes - 6 to 16 h.p.

C - series
Pumps— 3 sizes - 2 to 9 g.p.m
Motors— 2 sizes - 2 to 4 h.p.

mountings	shafts	porting
flange pad	tapered	right or left side
wide flange	splined round	end

OIL HYDRAULIC VALVES



3 4" tandem — any type section furnished in any combination of sections

1 3" tandem — any type section furnished in any combination of sections

1 3" unit — any type control or spool action as required

control types—	spool actions—	portings—
single, double or double with float positica	spring return, poppet detents or combination	top or side inlet top, end or bottom outlet

valves can be furnished with or without built-in relief valve

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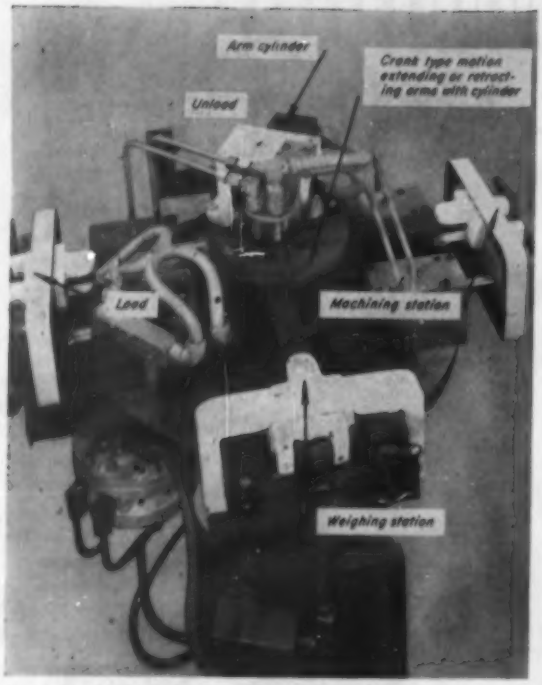
5A-51



CONNECTOR RODS are transferred between the 4 stations shown here. A reciprocating rotary motor indexes the loaded arms 90 degrees counterclockwise and returns the arms after the workpieces have been unloaded.

A SMALL hydraulic cylinder at each station powers the clamp fingers. Limit switches at lower right are tripped by the rotation of the indexing motor.

Oil Powered ROBOT *Does* WORK *of Many Hands*

● By Bruce Barton and Jack K. Grimm

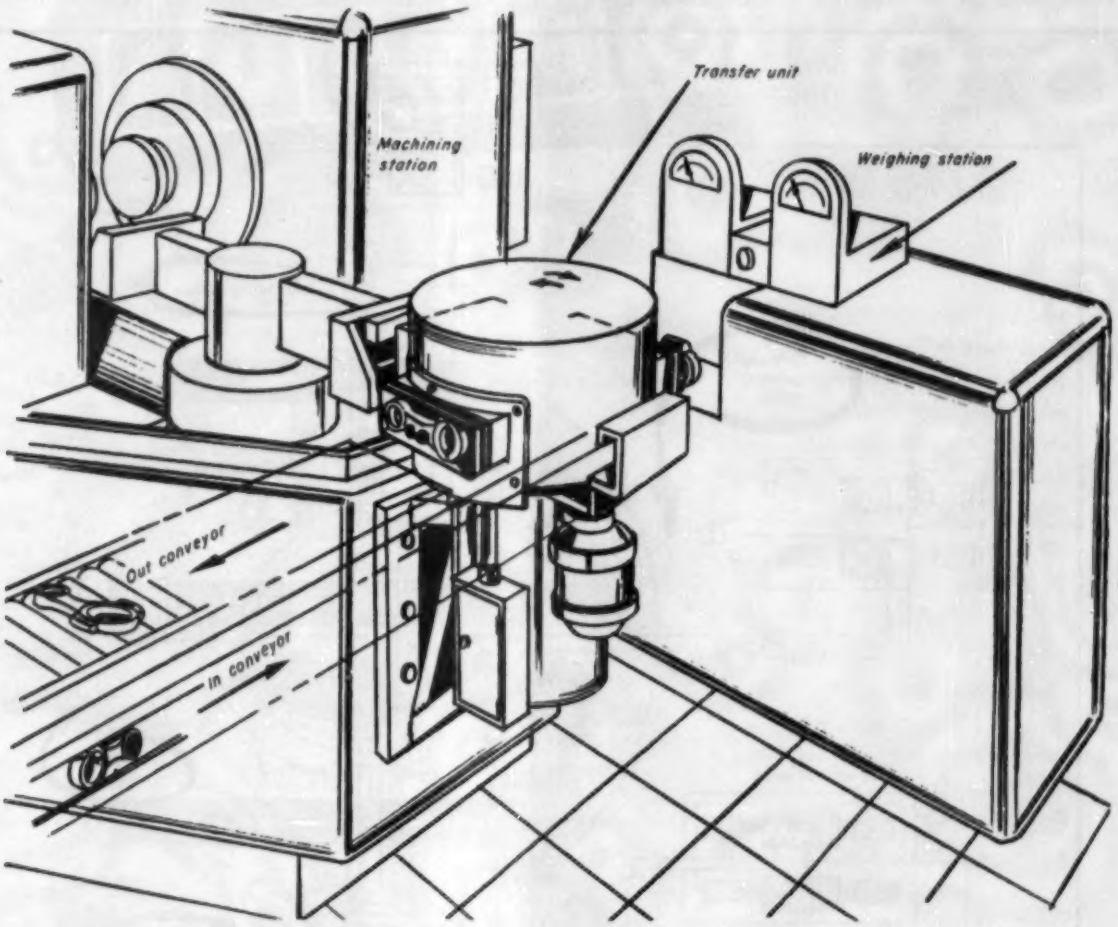
TODAY'S conventional approach to mechanization is to link standard automatic machine tools with automatic handling devices. Using this approach, the tool engineer and plant layout people locate their machines in what they hope to be the best pattern for smooth flow of materials through all production operations. Then comes the job of designing transfer devices and conveyor systems to complete the network.

Design of the transfer mechanisms is often a real challenge. Although the tool engineer might use some of the standard transfer sections which have been developed in recent years, his layout and timing requirements usually require a special design. Unlike the design of press dies, drill jigs and milling fixtures where over the years many standard techniques have become available, for the design of transfer mechanisms there is no large backlog of standard designs which can be slightly modified to fit the specific job. Not only is considerable ingenuity required, the tool engineer now takes on the role of a machine designer as he must be familiar with air, oil and electrical systems to power and control his fixture.

The transfer device illustrated in this article is typical of the specialized handling equipment which is becoming a part of production lines. Designed and built by Hautau Engineering Company, Detroit, this rotary transfer unit moves automotive connector rods between two radiating load and unload conveyor lines and the two work stations. The part must be picked up from an incoming conveyor and indexed 90 degrees to a weighing station where it is released for that operation. At the same time a weighed part is picked up, indexed and unloaded at the machining

BRUCE BARTON, JACK K. GRIMM, Design Engineers, Hautau Engineering Co., Detroit, Mich.

You might call it a work positioning station in a production line. But in a 3 second cycle it does more than just position the work.



station, and a machined part is picked up, indexed and unloaded on the outgoing conveyor.

Picking up, releasing and indexing the workpiece is powered hydraulically. Electrical control provides a 3 second cycle which is interlocked with the automatic cycles of the weighing and machining stations.

One 2 inch bore, 2 inch stroke cylinder powers the arms which must move out over the conveyor to pick-up or unload a workpiece. At the incoming, weighing and machining station a 1 inch bore, ½ inch stroke cylinder operates to clamp and unclamp the work. Indexing is powered by a rotary reciprocating vane type fluid motor.

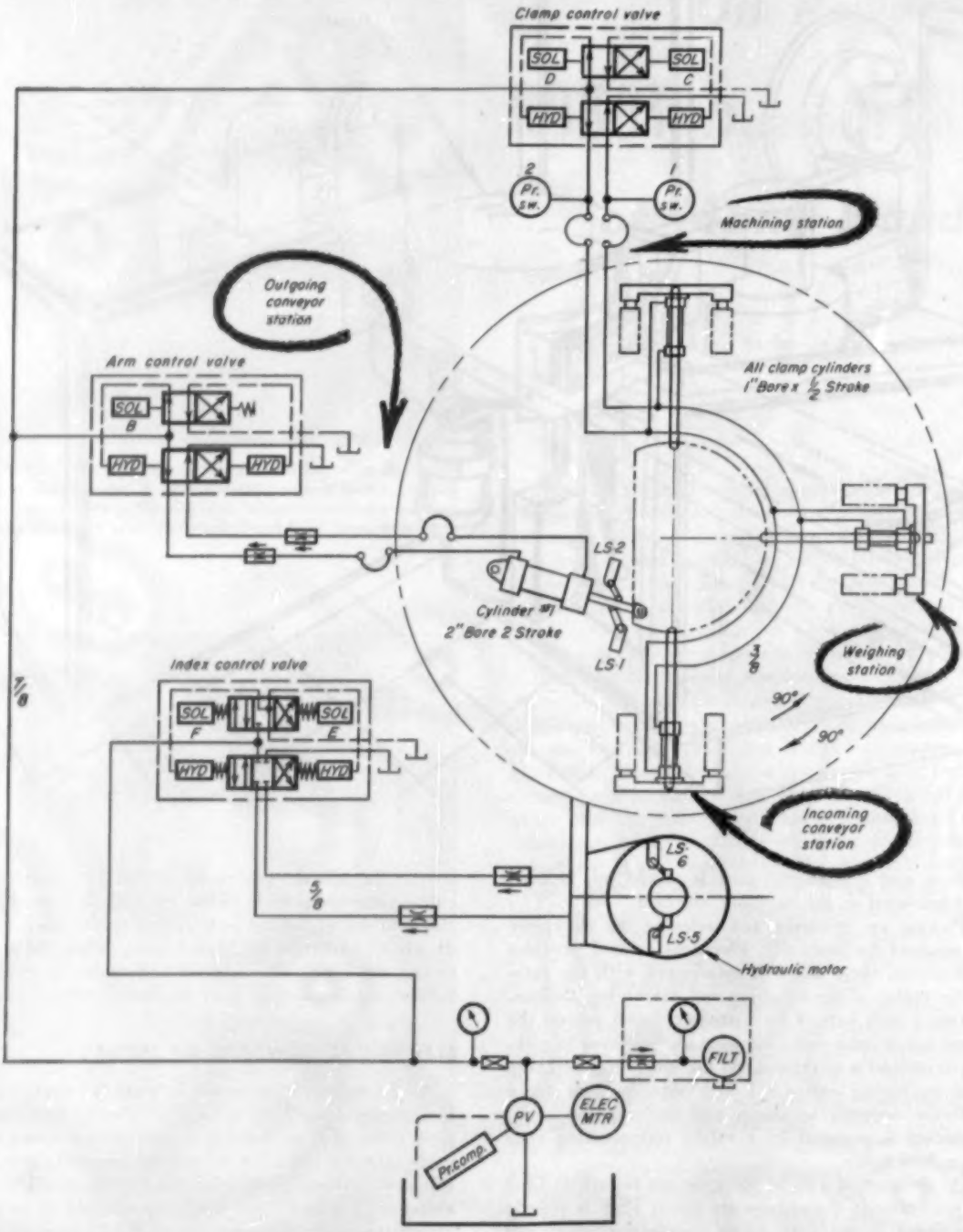
At the start of a cycle, the arms are retracted; LS-2 is held closed; the clamps are open; PS-2 is closed; the index is ready to rotate counterclockwise; and LS-5 is engaged. Pressing the cycle start button energizes solenoid B in the arm control valve directing pressure oil to cause the arms to move out. LS-1 is tripped to initiate the clamp action by energizing clamp valve solenoid C. When the clamps close, PS-1 closes to deenergize the arm control valve which then directs oil to retract the loaded arms. When the arms retract, LS-2 trips closed to start the indexing motion by energizing solenoid E of the index control valve.

ELECTRICAL CONTROL OF INDEX

As the reciprocating motor indexes the work, LS-5 is disengaged and LS-6 is engaged. Closing LS-6 energizes solenoid B on the arm control valve to cause the arms to move out ready to unload the workpieces at the new stations. The combination of closed limit switches LS-6 and LS-1 energizes solenoid D to unclamp the work. Pressure switch PS-2 closes to deenergize solenoid B which causes retraction of the empty arms. As LS-2 closes, the combination of closed switches LS-2 and LS-6 energizes solenoid F on the

index control valve to provide for clockwise return of the arms. Return of the index, trips LS-5 to make the circuit ready for the next cycle which is initiated by pushbutton if the selector switch is not in its automatic position.

Except for interlocking relay contacts which electrically link the transfer cycle with the machining and weighing operations, this transfer mechanism is a complete package by itself.



HYDRAULIC LINES from the cylinders are connected to a manifold on which the three directional control valves are mounted. Hydraulic power at about 250 psi is supplied by a 12 gpm variable volume vane pump.

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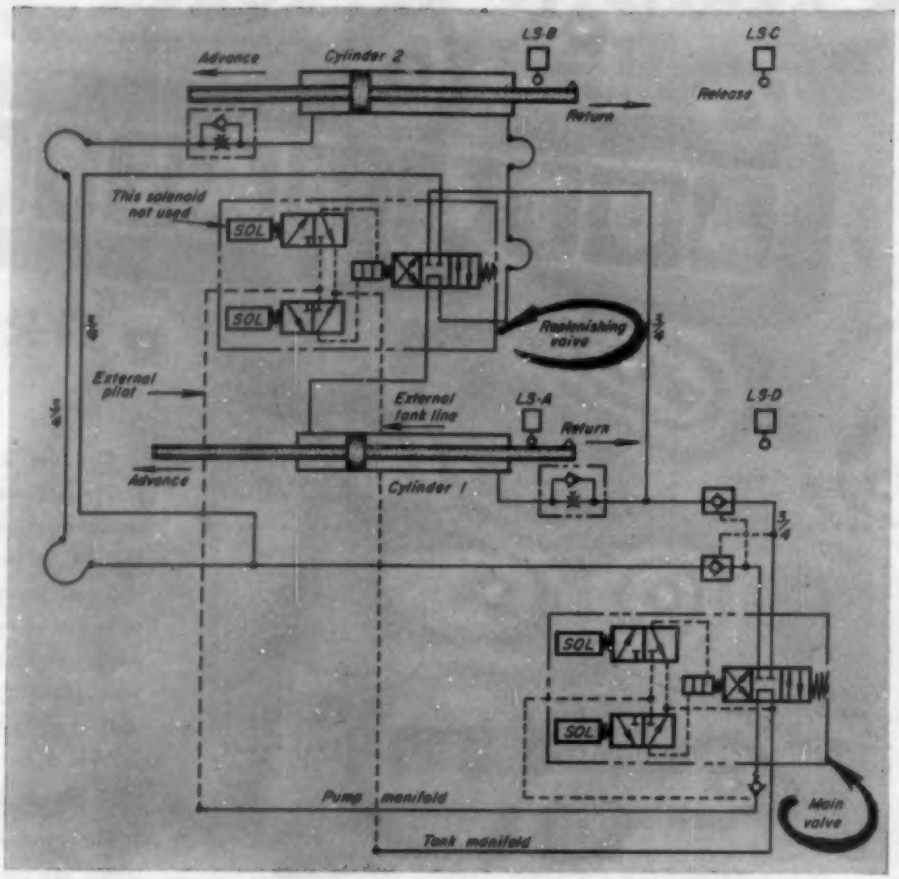

SOLENOID OPERATED REPLENISHING valve compensates for leakage on this motion synchronizing circuit.

REPLENISHING CIRCUIT

keeps series connected CYLINDERS IN STEP

To prevent oil leakage from upsetting the synchronized motion of two 30 inch stroke series connected cylinders, the engineers at the Wilson Automation Company, in Detroit, worked out an automatic replenishing system.

Theoretically, two identical double ended cylinders connected in series so that that oil from the first cylinder flows to the second cylinder should move together. In service, however, oil leakage upsets this theory.

Wilson engineers found that oil leakage for each stroke is not enough to cause trouble if they could arrange the circuit so that the cylinders would start each stroke together. The replenishing valve does this job by directing additional oil into the lagging cylinder at the end of each stroke. Without the replenishing valve, the effects of leakage would keep adding up until the cylinders became so badly out of step that they would fail to perform their intended job.

Here's how the circuit works. With the replenishing valve in neutral a conventional series hook-up exists. Cylinder 1 is supplied by the pump, and cylinder 2 gets its oil from cylinder 1. If both cylinders end the advance stroke together, LS-A and LS-B trip to reverse the main valve directing the pump supply to cylinder 2 and cylinder 2 supplies cylinder 1 for the return stroke. On the advance stroke, leakage will cause cylinder 2 to lag. LS-A will trip before LS-B. This will result in shifting of the replenishing valve to divert pump delivery from cylinder 1 to cylinder 2 to supply sufficient oil to complete the stroke of cylinder. LS-B will trip, the replenishing valve will return to neutral and the reverse stroke will be initiated. At the end of the reverse stroke the replenishing action will take place again if LS-C and LS-D are not tripped simultaneously.

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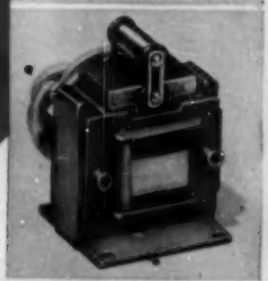

VERTICAL PULL TYPE—SHOCK-MOUNTED

VERTICAL PUSH TYPE—WELDED BASE

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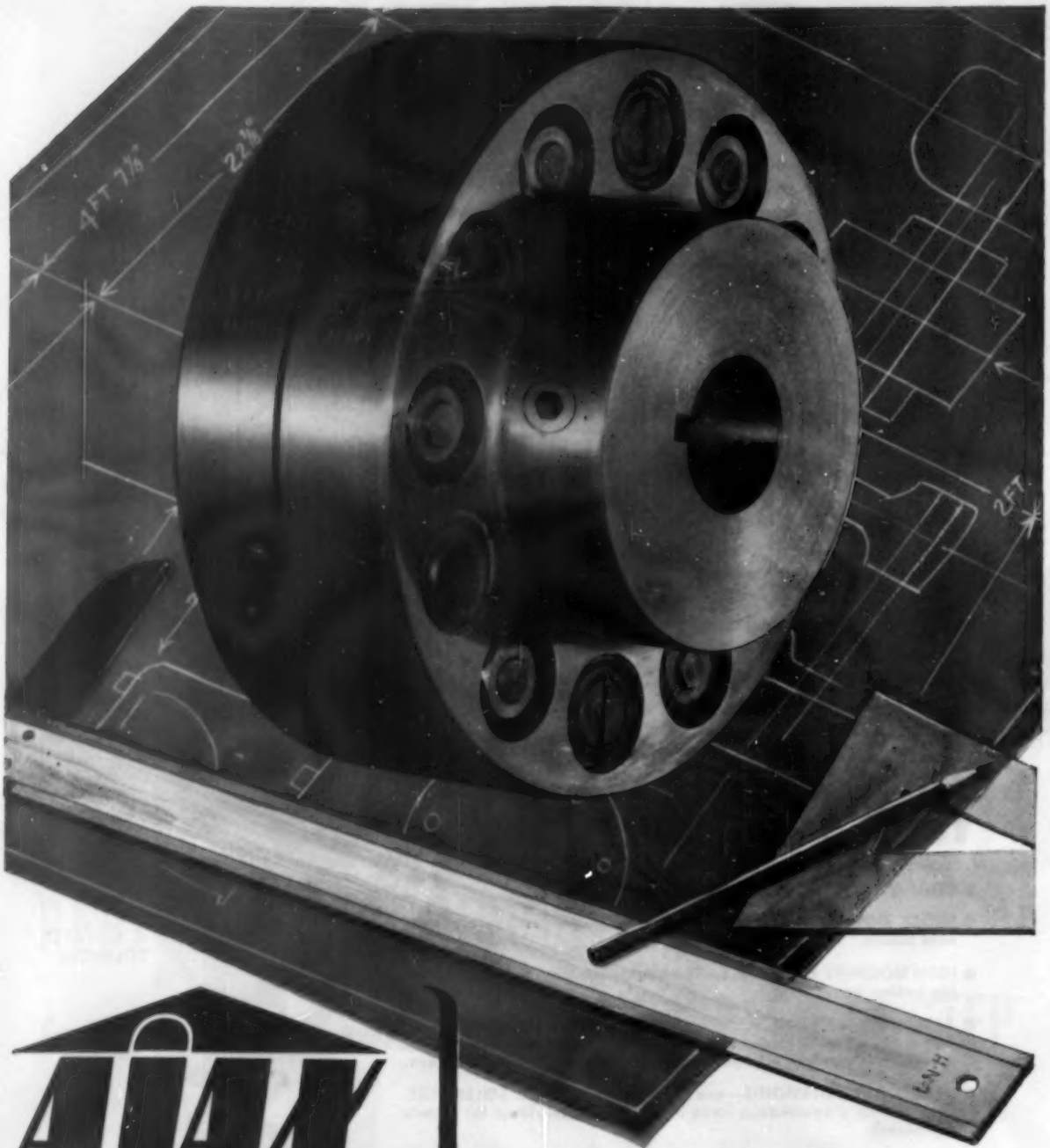

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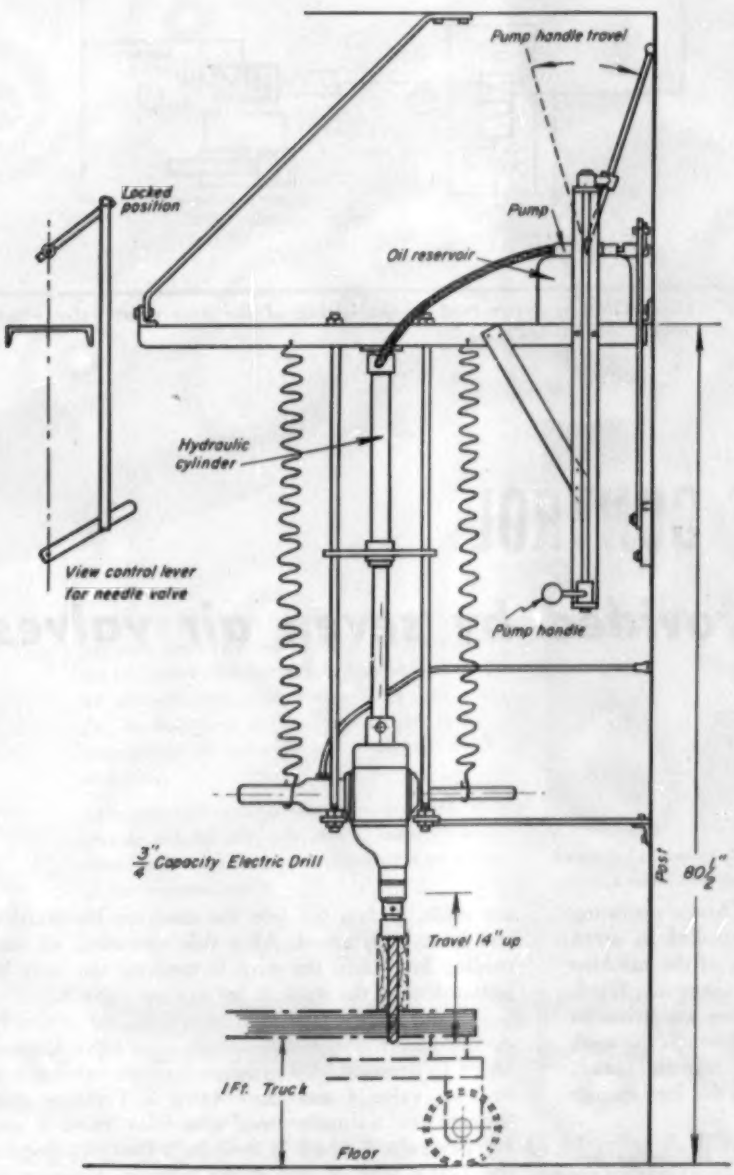
How to Put a Hydraulic Feed on a PORTABLE ELECTRIC DRILL

By Halvor E. Anderson

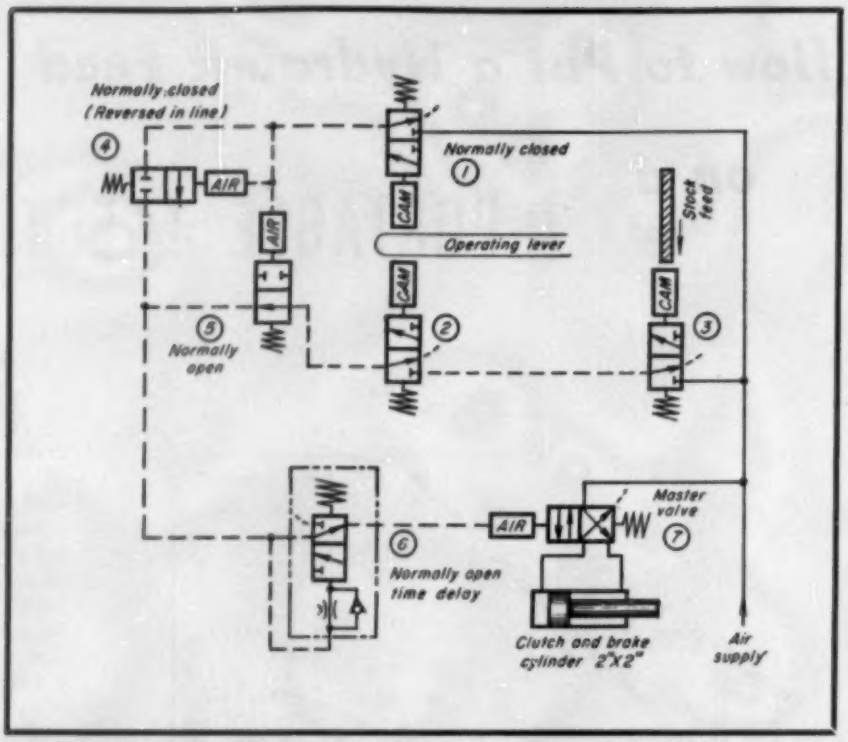


The fixture shown in the drawing is in use at Holm's Mfg. Co., Kenosha, Wis. It's used for drilling hard wood skids which measure 5 x 10 feet. The drilled holes, 13/16 inch diameter 10½ inches deep, are mounting holes for a radial engine which gets placed on the skid. The drilled bolt holes are also counterbored for the nut.

Because the skid is large, any column type drill press which could handle this job would be expensive. Doing the operation by hand with a portable drill proved very difficult because the torque was terrific in such a deep hole. Use of a portable drill and the inexpensive fixture which holds and feeds the drill solved this tooling requirement very easily.

A 1½ inch bore single acting hydraulic cylinder having a 14 inch piston travel is mounted on the 8 inch channel bracket which is bolted and braced to a post in the shop. On the end of the piston, an adapter is mounted to hold the electric portable drill. The drill chuck holds a 13/16 in diameter single spiral drill and a 2 inch diameter counterbore.

This setup leaves the floor area clear, permitting the use of a floor truck to position the skid under the drill. The needle valve on the oil reservoir is closed by movement of the valve lever. The pump lever is then moved to pump oil to the cylinder which feeds the electric drill which is rotating at 900 rpm. After drilling through the work, the needle valve is opened, releasing oil pressure from the cylinder. Springs lift the drill and piston out of the work to the top of the stroke. Sufficient spring tension is required to force oil back into the reservoir.



MACHINE CYCLE TIME is determined by the setting of the time delay valve which regulates the brake "off" time.

SAFE CUT-OFF CONTROL

...is provided by seven air valves

● By Wesley Grotewohl

ONE air powered clutch and brake operating cylinder on a cut-off machine is controlled by seven air valves to provide safe sequencing of the machine cycle. Built by Windsor Tool and Die Company, Windsor, Ontario, the machine cuts, pierces and trims in one hit, automotive leaf springs. Operation of the work tools depends on the actuation of the brake and clutch.

When the strip stock, from which the leaf springs are made, is first fed into the machine, the starting end must be trimmed. After this operation, all succeeding hits, until the strip is used up can only be initiated when the stock is fed against valve 3.

To perform the first trim operation, the manually operated lever is moved to actuate pilot valve 1, opening it to pressure. Air pressure through valve 1 acts to open valve 4 and close valve 5. Pressure goes through the normally open time-delay valve 6 and reverses valve 7 which is the master control valve for the 2 inch bore, 2 inch stroke cylinder. Pressure on

WESLEY GROTEWOHL, manager, Detroit engineering service, Ross Operating Valve Company.

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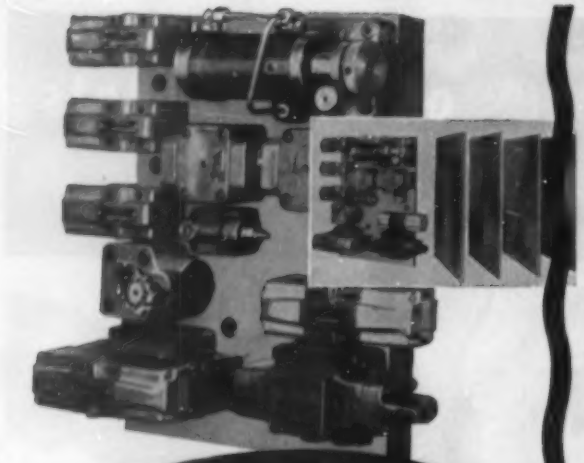

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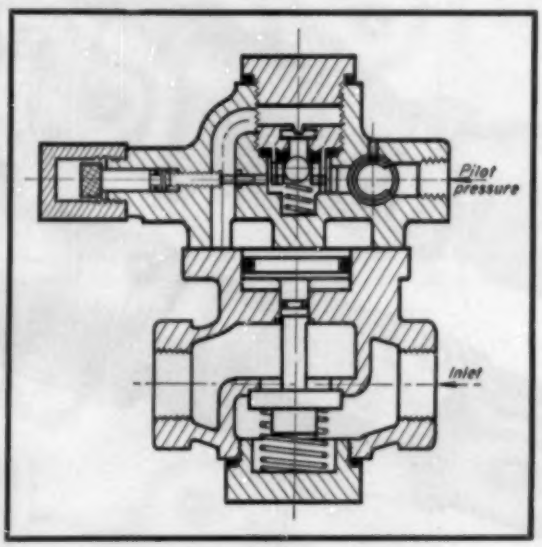
the head end of the cylinder causes release of the brake and engagement of the clutch.

Valve 6 is designed so that there is a delayed actuation when pilot pressure is applied, and an immediate reversal of the valve poppet when pilot pressure is exhausted. This valve makes it impossible for the machine to repeat if the operator should hold valve 1 actuated. Here's why. With valve 6 being a normally open valve, pilot pressure immediately acts to shift valve 7 to direct air pressure to engage the clutch. The machine operates in the time it takes for the time delay device to permit pilot pressure to close valve 6 exhausting pilot pressure on valve 7 and stopping the machine. Valve 6 will not reset to the open position



CROSS-SECTION of the time delay valve. This is a 3-way normally closed valve which provides delayed actuation when pilot pressure is applied, and immediate reversal when the pilot pressure line is open to exhaust.

unless valve 1 is released. Releasing valve 1 removes pilot pressure on the time delay valve.

With the first trim operation completed, the stock is moved in to mechanically open valve 3. The operator actuates the lever to open valve 2. Air pressure passes through valve 5 and 6 to operate valve 7 and complete the cycle as before. Use of valve 3 makes cycling by actuation of valve 2 impossible unless the stock is properly positioned to open valve 3. Valves 4 and 5 permit common use of the pilot line to valve 6.

To prevent pressure from valve 5 from escaping through valve 4, instead of going to valve 6, valve 4 is connected backwards as noted on the circuit drawing. In this direction, valve 4 acts as an automatic check when no pilot pressure is acting on the poppet.

This all-air circuit provides single stroke action with safety interlocks.

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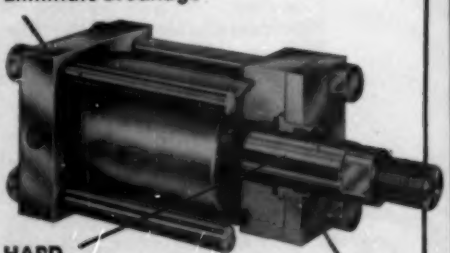

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1½"	8"	Non		65.10		68.00		73.30		79.45
1½"	11"	Non		68.40		71.30		76.60		82.75
2"	2"	Non	$ 37.70		$ 39.75		$ 42.30		$ 44.60	
2"	4"	Non	39.40		41.45		44.00		46.30	
2"	6"	Non	41.10		43.15		45.70		48.00	
2"	8"	Non	42.80		44.85		47.40		49.70	
2"	11"	Non	45.35		47.40		49.95		52.25	
2"	3"	Both	62.05	94.50	64.10	97.45	66.65	103.05	68.95	111.55
2"	5"	Both	63.75	97.00	65.80	99.95	68.35	105.55	70.65	114.05
2"	7"	Both	65.45	99.50	67.50	102.45	70.05	108.05	72.35	116.55
2"	9"	Both	67.15	102.00	69.20	104.95	71.75	110.55	74.05	119.05
2"	13"	Both	70.55	107.00	72.60	109.95	75.15	115.55	77.45	124.05
2½"	2"	Non	41.45	73.30	43.70	76.25	46.25	82.30	49.00	93.10
2½"	4"	Non	43.35	76.00	45.60	78.95	48.15	85.00	50.90	95.80
2½"	6"	Non	45.25	78.70	47.50	81.65	50.05	87.70	52.80	98.50
2½"	8"	Non	47.15	81.40	49.40	84.35	51.95	90.40	54.70	101.20
2½"	11"	Non	50.00	85.45	52.25	88.40	54.80	94.45	57.55	105.25
3¼"	3"	Both	77.80	126.85	80.35	131.20	84.15	138.60	87.70	149.95
3¼"	5"	Both	79.80	129.85	82.35	134.20	86.15	141.60	89.70	152.95
3¼"	7"	Both	81.80	132.85	84.35	137.20	88.15	144.60	91.70	155.95
3¼"	9"	Both	83.80	135.85	86.35	140.20	90.15	147.60	93.70	158.95
3¼"	13"	Both	87.80	141.85	90.35	146.20	94.15	153.60	97.70	164.95
4"	2"	Non	56.25	106.00	59.10	111.15	62.95	118.90	67.30	132.80
4"	4"	Non	58.85	109.40	61.70	114.55	65.55	122.30	69.90	136.20
4"	6"	Non	61.45	112.80	64.30	117.95	68.15	125.70	72.50	139.60
4"	8"	Non	64.05	116.20	66.90	121.35	70.75	129.10	75.10	143.00
4"	11"	Non	67.95	121.30	70.80	126.45	74.65	134.20	79.00	148.10
5"	3"	Both	98.25		101.40		105.25		110.60	
5"	5"	Both	101.65		104.80		108.65		114.00	
5"	7"	Both	105.05		108.20		112.05		117.40	
5"	9"	Both	108.45		111.60		115.45		120.80	
5"	13"	Both	115.25		118.40		122.25		127.60	
6"	2"	Non	80.60		83.95		87.85		94.15	
6"	4"	Non	84.90		88.25		92.15		98.45	
6"	6"	Non	89.20		92.55		96.45		102.75	
6"	8"	Non	93.50		96.85		100.75		107.05	
6"	11"	Non	99.95		103.30		107.20		113.50	
8"	3"	Both	157.35		161.05		167.90		174.95	
8"	5"	Both	162.45		166.15		173.00		180.05	
8"	7"	Both	167.55		171.25		178.10		185.15	
8"	9"	Both	172.65		176.35		183.20		190.25	
8"	13"	Both	182.85		186.55		193.40		200.45	

Miller "Stock" Cylinders fully meet the J.I.C. Standards and are identical to Miller "Custom-Built" Cylinders in design and construction.

"Stock" Air Cylinders are for 200 psi operation, "stock" hydraulic cylinders for 2000-3000 psi operation. Piston Rods of "Stock" Cylinders are "Style No. 2 Standard."

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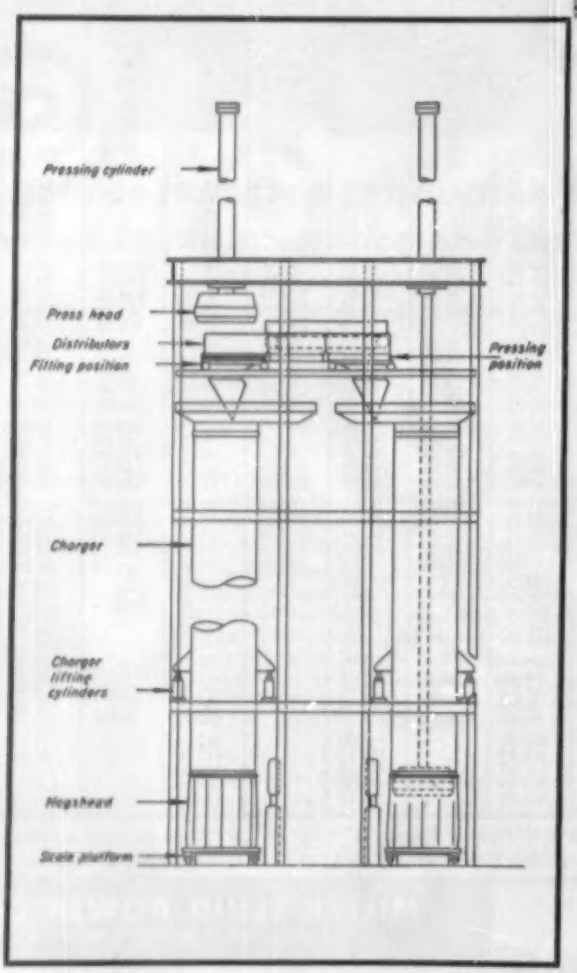
SINGLE STROKE COMPACTING

● By C. C. Fishburne

THE PRESSING cylinder rams extend above the penthouse of the plant. The prefill tank supplies the large volume of oil required to assure fast, even speed for the pressing cycle.

ELEVATION sketch of main features of single stroke hogshead filling press.



A NEW type, top ram operated, hogshead filling press, which compresses a weighed volume of tobacco in one stroke and is fully hydraulic in operation, has been introduced with considerable success by Standard Designers, Inc., Asheville, N. C. The operation of twelve auxiliary cylinders, six in each half of the two ram machine, are automatically controlled from a single hydraulic power package. Two pairs of double pumps driven by a double-ended motor, supply high pressure for the ram travel and low pressure for the auxiliary cylinders. In addition to packing the tobacco evenly and much faster than older multi-tap methods, the two ram press is able to handle the output of two heavily loaded dryers, approximately 25,000 pounds per hour, much greater than that of any other tobacco press in previous use.

The conventional method of packing hogsheads employed in tobacco plants for several generations involved repeated packing. The empty hogshead was placed on a dolly and a sleeve or charger, about three feet in height, was fitted to the top of the hogshead. The hogshead and charger was then filled with loose tobacco and moved into an up-packing press, under a packing drum. Following the packing operation, the free space was again refilled and the operation repeated. It often required eight or nine such cycles to press the usual 900 to 1100 pounds of tobacco into hogshead. This resulted in layers of tobacco of varying density, not conducive to proper aging.

Prime conditions for ideal packing are: (1) uniform

C. C. FISHBURNE, Engineering Department, Standard Designers, Inc., Asheville, N. C.

PRESS . . . *new ram application*

filling; (2) pressing that will not cause layers; and, of course, (3) minimum use of man power.

Another problem that had to be solved was the assurance that oil would not possibly leak into the tobacco. Only a few drops of oil would permeate and spoil the entire contents of a hogshead of tobacco. For this reason, all previous tobacco presses used a cylinder or ram beneath the floor. The use of the overhead cylinder press in the tobacco industry required a cylinder that could be operated without oil leaks. A gland was developed which incorporates a double layer of packing with an intermediate drain. With this gland, the overhead cylinder press was practical. Another advantage of the overhead cylinder press is the simple foundation requirement. Present designs call for a pit only five inches deep. This design also makes possible the fully portable press, which can be set up on any warehouse floor.

The overhead cylinder or ram packing press, as developed by Standard Designers, is a twin ram machine, operated by a two pressure hydraulic system; the high pressure circuit operates the ram, the low pressure circuit operates the movement of the distributor, the raising and lowering of the chargers, raising and lowering of the dolly and hogshead on the press frame and moves the dolly in and out of the press.

Tobacco passes from a dryer immediately prior to delivery to the press. A conveyor belt takes tobacco away from the dryer in a continuous stream at the rate of 12,000 to 15,000 pounds per hour. In order that the flow may be uninterrupted, two presses are filled alternately by a reversible belt which is fed by the main conveyor from the dryer.

Uniform filling is accomplished by a rotating distributor spout which feeds the tobacco evenly over the area beneath.

THIRTY FOOT CYLINDER STROKE

In order to obtain uniform packing the operation must be done in one stroke. This requires a cylinder out of the ordinary. The charger or area above the hogshead which is filled with loose tobacco, must be more than twenty feet high to hold the full charge of 900 to 1100 pounds. Since the press head must rise above the distributor, the cylinder stroke must be a full thirty feet.

The loading conditions required that the cylinder material should be a 7 in ID, one inch wall, seamless steel tubing. Since such tubing was not available in 30 foot lengths, the problem was solved by designing a welding spline that held the inner surfaces of the mating tubes perfectly concentric. The bore of the cylinder was finished, after splining, by honing and polishing.

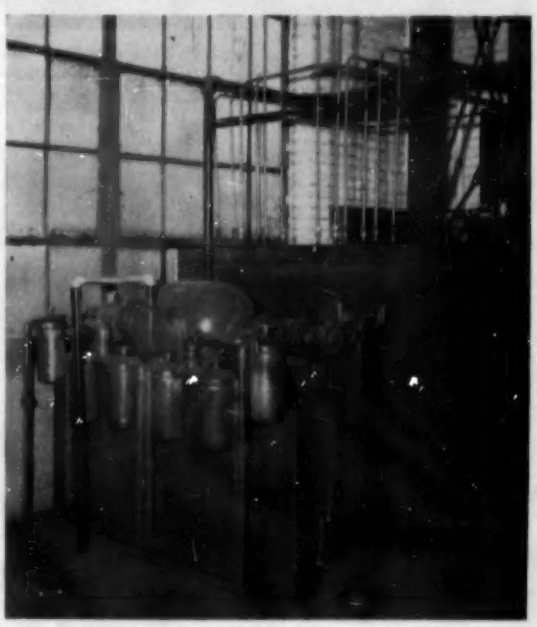
In operation, the pressing cylinder has a free fall of about one-half of a full stroke. A prefill system, with tank mounted on the top of the cylinder, was used to supply oil required for the down stroke. This was important since the speed of the pressing cycle, 30 seconds, was critical.

The sequence of operations is as follows:

(1) With the reversing conveyor running toward the right, for example, the tobacco is fed into the right hand charger and hogshead.

(2) When the weight of the tobacco reaches a predetermined amount (900 to 1100 pounds), the scale trips a limit switch, which causes the conveyor to reverse direction, the right hand distributor cylinder to retract and light a signal on the operator's control panel.

THE PACKAGE unit has two double pumps, each pair of which supplies a main ram and the auxiliary cylinders of one filling unit.



SINGLE STROKE COMPACTING PRESS

THE RIGHT HAND pressing head is shown fully retracted above the distributor head. The roller operated limit switch, actuated as the ram begins to descend, retracts the scale cylinders transferring the load from the dolly to the press frame.

THE REVERSING conveyor (top) and the shuttling distributors. The latter are moved from one to the other filling positions by horizontally mounted cylinders.

SECOND FLOOR of the three story installation showing the central section of the chargers, package power unit and a part of the distribution system.

(3) With the distributor retracted, the operator has control over the main ram. He moves the main ram down by means of a lever controlled valve, pushing the charge of tobacco into the hogshead.

(4) The operator raises the pressing head a few feet by reversing his valve; raises the charger a few inches, leaving a small open space between the charger and hogshead.

(5) The assistant operator slides the hogshead lid through this opening and over the top of the tobacco.

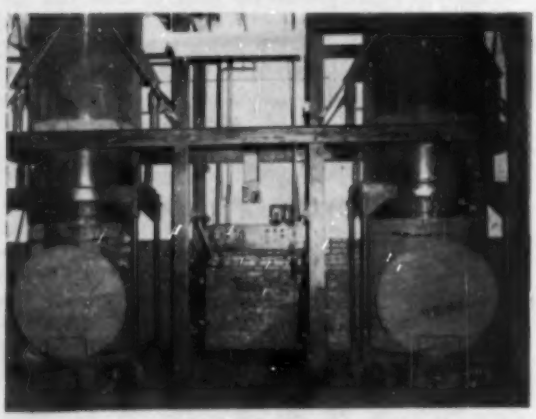
(6) The operator again drops the press head, forcing the lid into place under the lips of hogshead sides.

(7) The operator starts the ram on its retraction (upward) stroke, raises the charger by means of the two charger cylinders and, by push-button, moves the packed hogshead out of the press.

(8) The assistant moves a dolly with an empty hogshead into the filling position; the operator lowers the charger into the hogshead and a new cycle is begun.

When the press head is fully raised, a roller type limit switch is tripped; this causes the distributor to be moved into the filling position. As the distributor moves out, it locks the main cylinder control valve, so that the press can not be moved down at the improper time. The alternate pressing unit is ready for its filling operation, which begins automatically when the preset weight of tobacco has dropped into the charger.

The new two ram packing machine was designed to handle the output of one dryer, or approximately 15,000 pounds per hour. However, on a recent test, the output of two heavily loaded dryers was run through the machine and 25,000 pounds per hour were packed. An operator and an assistant handled the whole operation. The previous short stroke presses required, to maintain the same production, a battery of presses and the labor of approximately 12 men.



LOADING POSITIONS and operator's station of the double press. Charger lifting cylinders and front end of the dolly loading and unloading unit are shown.

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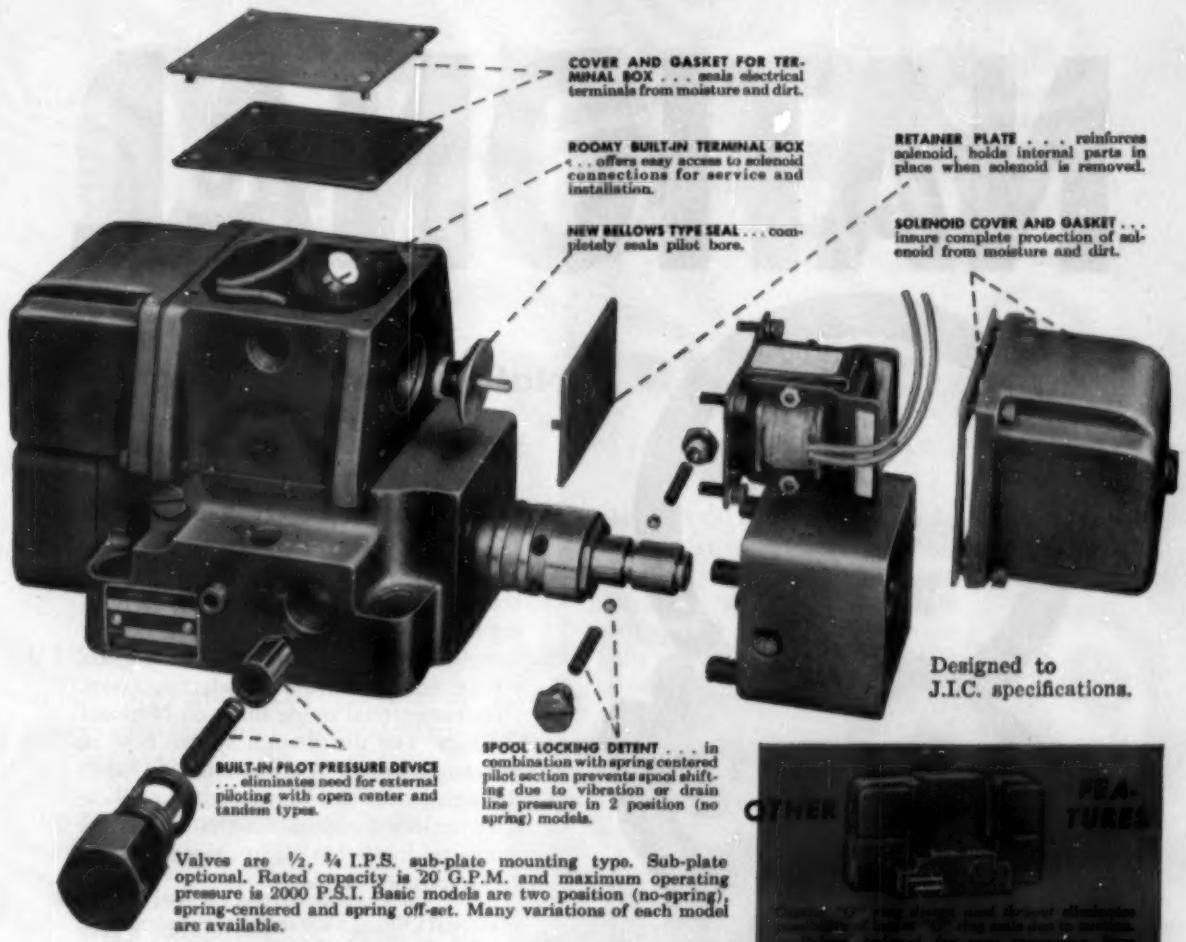

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ROOMY BUILT-IN TERMINAL BOX . . . offers easy access to solenoid connections for service and installation.

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RETAINER PLATE . . . reinforces solenoid, holds internal parts in place when solenoid is removed.

SOLENOID COVER AND GASKET . . . insure complete protection of solenoid from moisture and dirt.

Designed to J.I.C. specifications.

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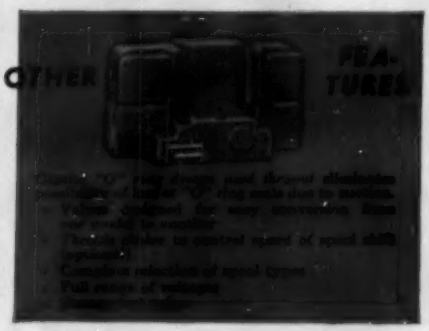

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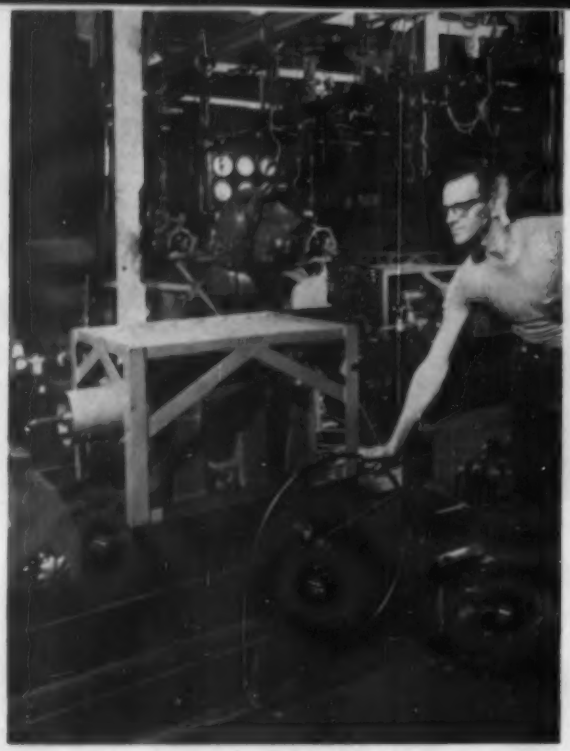


FIG. 1. MOVEMENT of the handwheel controls a servo valve which directs oil pressure to move the carriage.

A light touch on the hand wheel controls 1200 pounds as a . . .

SERVO CONTROLLED POWER CYLINDER

positions the load

● By Walter C. Carruth, Jr.

ALTHOUGH hydraulic power assist is being widely used to steer automobiles and other vehicles, its application for positioning heavy machine slides is only beginning to be exploited. Among the many available methods of moving machine slides, the use of hand control with a servo type hydraulic assist offers distinct advantages which other systems can not provide.

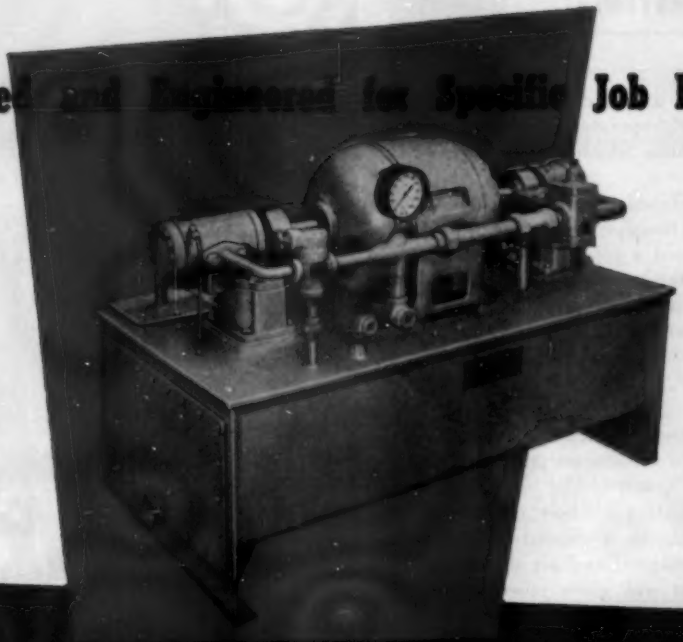
On the machine shown in Figures 1 and 3, the tool engineers at Chevrolet-Cleveland, Division of General Motors, built into the bed a compact booster cylinder with integral servo valve. This machine is a test stand used to check out automatic transmissions. With the transmission clamped in the headstock of the stand, the operator must move the dynamometer, located on the tailstock end of the bed, into engagement with the transmission. Movement of the heavy dynamometer is done with the help of the hydraulic system.

Safe, fast engagement of the splined shaft on the dynamometer with the internally splined universal joint on the transmission requires a power system which is simple to operate. Determining what system to use to move the dynamometer carriage was a difficult part in the design of the test stand. The dynamometer, coupling, spline, brake assembly and guard are all mounted on the moveable carriage. Their total weight is nearly 1200 pounds.

To move this load easily and safely and to properly mate the splines, use of both cable and chain drives

WALTER C. CARRUTH, JR., Machine Designer, Chevrolet-Cleveland Division, General Motors Corp.

Designed and Engineered for Specific Job Requirements



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operated by the handwheel was studied. These methods were ruled out because of operator fatigue and the large amount of maintenance which would be necessary.

Next, a gear box was designed to gain a mechanical advantage to move the unit through a rack and pinion. Because this method required a great many rotations of the handwheel to move the carriage, another power source had to be studied. An electric gear motor which turned a multiple lead screw was next considered. It was turned down because simple start and stop control was not available.

Air power to move the carriage was also studied. The necessary "touch" control was lacking. Hydraulics was the next step. Early in the design planning, the suggestion to use a hydraulic system had been pigeonholed in favor of investigating cheaper mechanical systems. When these investigations showed the shortcomings of mechanical, electrical and air drives, the use of a hydraulic system was given more serious study.

First a layout of a hydraulic cylinder with a 4-way valve as the operating mechanism was made. However, because the older test stands used a handwheel it was desirable to keep the same operating mechanism so that the operators would go through similar motions except with much less effort. The use of the handwheel led to the thought of power steering the carriage into position. Space was a problem. While the bed of the test stand placed little limitation on length of the cylinder, it did limit the cross-sectional area. Several hydraulic steering boosters used in the earth-moving machine industry were investigated. The hydraulic assist unit most adaptable for size and shape, stroke, placement of operating levers and mountings was one that has a servo valve attached to the head end of the cylinder, Figure 5.

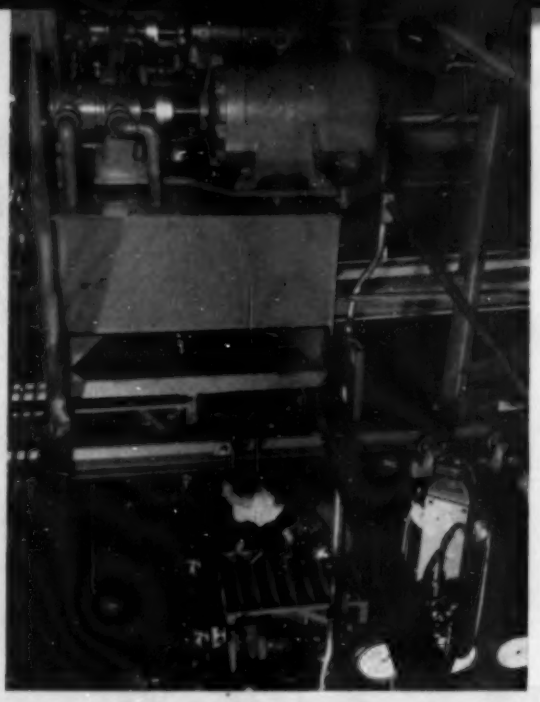


FIG. 2. HYDRAULIC POWER for the test stands is supplied by these power packages which are located on a balcony above the stands.

On this test stand, the hydraulic assist permits carriage movement of 6 inches at a maximum rate of about 10 fpm. Use of the servo control allows the operator to stop, start, return or jog at any place in the carriage stroke. Figure 4 illustrates the mounting arrangement of the power unit in the bed of the ma-

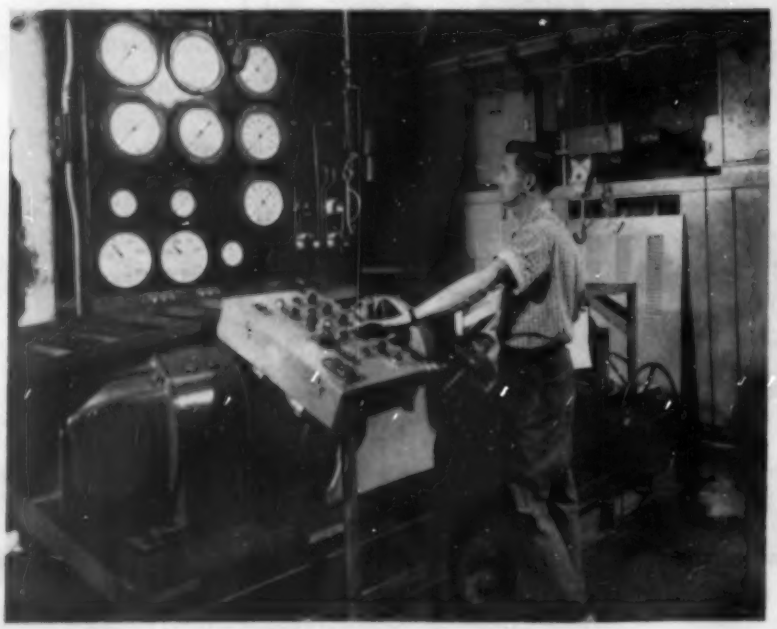


FIG. 3. AUTOMATIC "Power-Glide" transmissions are checked out on this test stand. With the dynamometer splined into the transmission, operation, noise and pressures are checked at all shift points at speeds comparable to those encountered in a car.

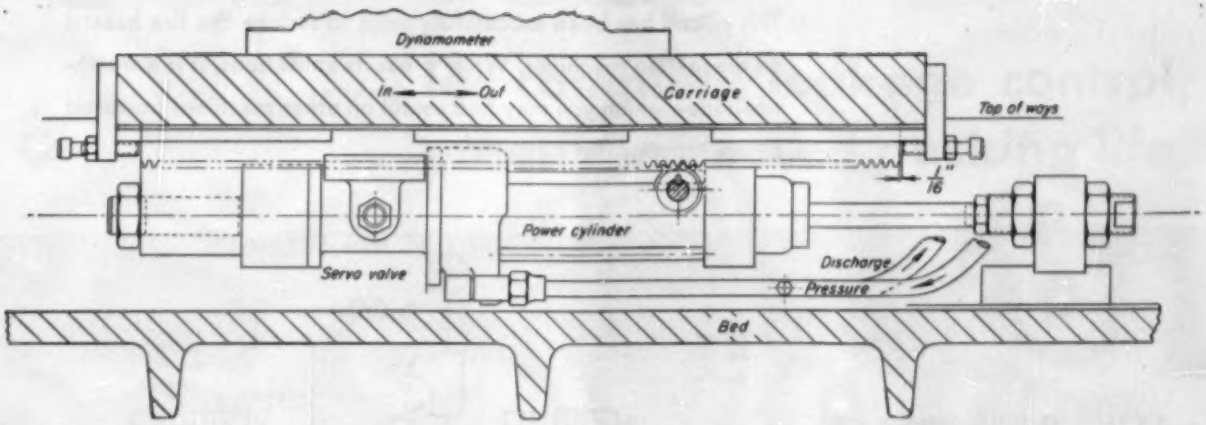


FIG. 4. THE PISTON rod of the power cylinder is rigidly fastened to the bed of the test stand. The cylinder body and servo valve move with the carriage. Movement of the pinion by the handwheel causes movement of the servo valve. The pinion drives the rack a maximum of 1/16 inch to actuate the valve control arm.

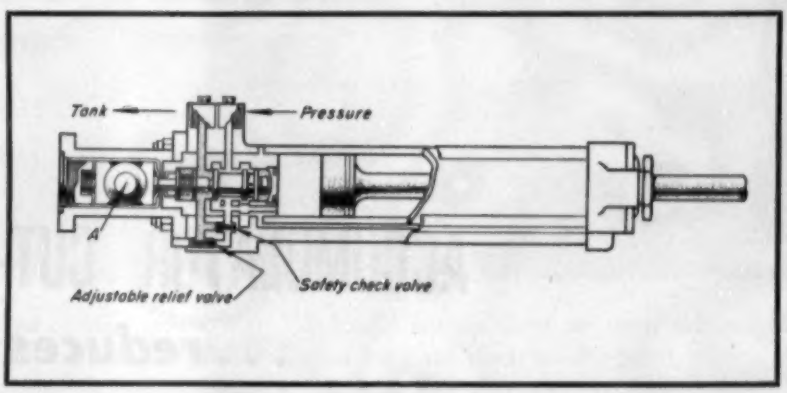


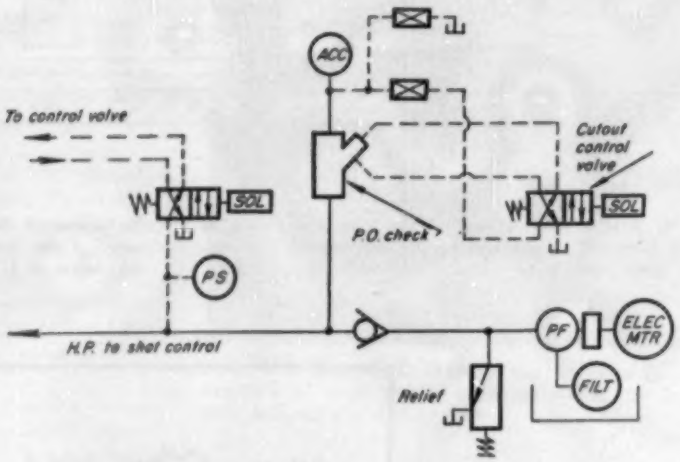
FIG. 5. CROSS-SECTION of the power cylinder and servo valve illustrates the construction of this unit. On the test stand, the servo valve is actuated by the rack mounted arm which ties into the valve at point A.

chine. The handwheel is keyed to a shaft which is supported in the base of the stand and which has a pinion fixed to the other end. This pinion engages a rack which is free to move in either direction approximately 1/16 inch.

Bolted to the rack is an arm which is attached to the servo valve operating linkage. When the operator first moves the handwheel, he moves the pinion driven rack a maximum distance of 1/16 inch. This movement actuates the servo valve which opens to allow pressure oil to act against the rigid bed mounted piston causing movement of the hydraulic cylinder body which is mounted to the carriage. As the cylinder moves it carries along the entire carriage. As oil pressure moves the carriage, the pinion and its attached handwheel is being driven by the moving rack. Through this drive, the operator has complete sense of "feel". He only exerts enough effort to position the servo valve. Oil power takes over from there. The carriage is quickly stopped when the operator releases or stops moving the handwheel. Release of the handwheel causes the servo valve to be spring returned to neutral, stopping oil powered movement. Reversing the direction of the handwheel causes reversal of the servo valve to direct pressure to the opposite side of the power cylinder. With this arrangement, the carriage moves only when the handwheel is moved. Response of the servo system is fast enough so that engagement of the dynamometer and transmission splines can be made smoothly and safely. Adjustable stops are provided at each end of the rack so that the carriage can be moved by hand if there should be a hydraulic failure.

Figure 2 shows the hydraulic power package mounted on a balcony above the test stands. Two stands are powered from one double vane type pump, tank and motor unit. A 3 hp. 1200 rpm motor drives the double pump which delivers 3 gpm from each side. System pressure to move the carriage is less than 100 psi. With this low operating pressure, transmission of fluid from the balcony to the floor through flexible hose does not present any problem. The power demand is small and there is very little heat generated by oil discharged through the relief valve. When the carriage is not in motion oil circulates through the servo valve back to tank.

This circuit has been successfully used to reduce the fire hazard on diecasting machines. While it has its limitations, it is a worthwhile idea which you may find useful on other machines powered by an accumulator circuit.



A PRESSURE DROP caused a broken hydraulic line will open the contacts of a pressure switch to deenergize the solenoid valve which controls the accumulator cut-out valve.

ACCUMULATOR CUT-OUT CIRCUIT

...reduces fire hazard

● By Jack E. Bullen

IF there is a break in the hydraulic line on your machine will oil flow automatically stop? The drawing shows the accumulator circuit used on diecasting machines in the shops of McCulloch Motors Corporation, Los Angeles. Automatic shut-off of flow from the accumulator is accomplished by a pilot operated check valve which closes when pressure in the main line drops about 50 psi below the normal operating pressure drop of the accumulator.

The pilot check valve is controlled by a ¼ inch solenoid operated 4-way valve and a pressure switch. Maximum pressure setting on the accumulator is 1800 psi and the pressure drop during the cycle is approximately 125 psi. By setting the pressure switch to open at 50 psi below the cycle pressure drop, the 4-way valve is deenergized when the line pressure drops to 1600 psi.

With the 4-way valve solenoid deenergized, the pilot check valve shuts to prevent oil flow from the accumulator. Failure of the electrical system will deenergize the circuit to a "fail-safe" position. As a further safety measure, the pressure switch is in series with the electric motor. Opening of the pressure switch stops the pump drive as well as shutting off the accumulator.

When simulating a broken line by opening and closing a valve inserted in the main line, the machine shuts down each time with an approximate oil loss of two quarts. With this circuit, then the operator turns his machine off, he automatically isolates the accumulator and during the shut down period there is no loss of nitrogen through leaking valves or connections.

This circuit has some obvious limitations which make it more or less effective depending on the cycle of the machine on which it is used. In the event of a line break, oil will flow until the pressure switch operates to shut down the circuit. The amount of oil flow depends on accumulator size and the pressure switch setting.

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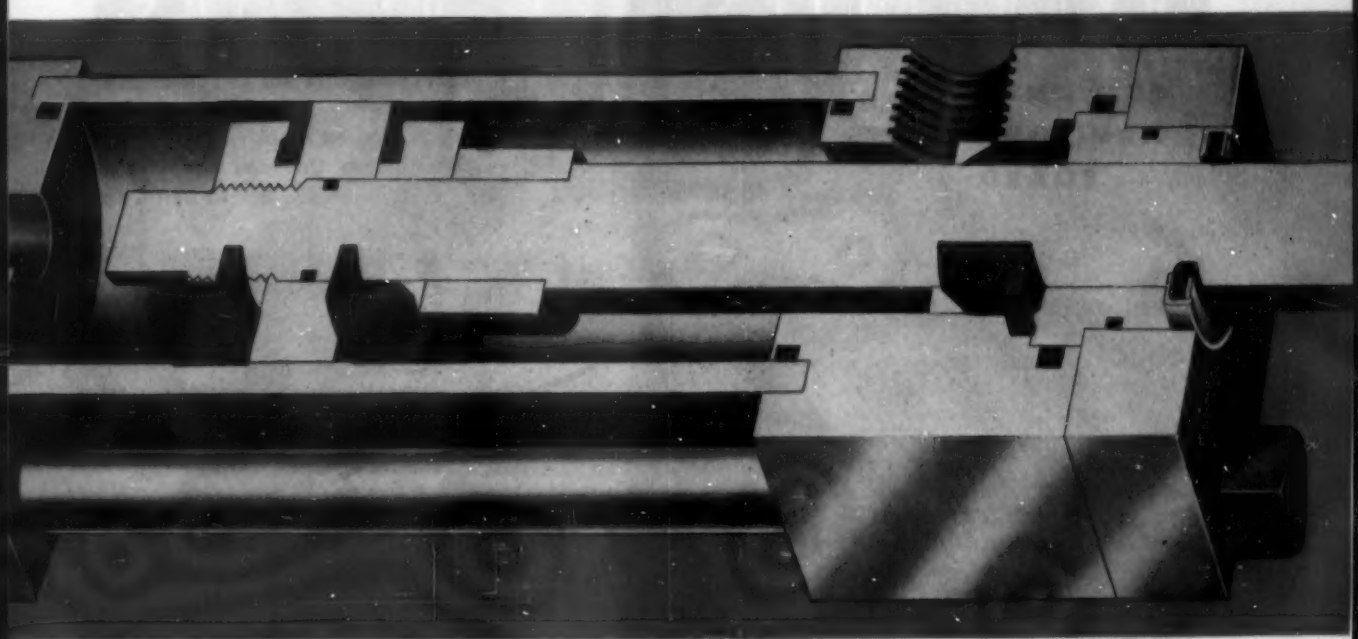

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Potential Advantages of the 5000 psi PNEUMATIC SYSTEM

● By A. E. Schmidlin

AS the use of aircraft pneumatics becomes more and more extensive, it becomes necessary to increase the amount of energy which can be derived from each pound of high pressure fluid carried in the system. As in all fluid power systems the obvious way of doing this is to raise the working pressure. Hence, recently there has been a great deal of activity in extending the service pressure of the aircraft pneumatic system from 3000 psi to 5000 psi.

The obvious advantages of such a system are:

1. A 5000 psi storage will allow higher sub-system pressures, up to 3000 psi. (In high pressure pneumatics systems, sub-system pressure must be appreciably below storage pressures).
2. A greater amount of the fluid medium under

A. E. SCHMIDLIN, assistant manager, Research and Development Dept., Walter Kidde & Company, Inc., Belleville, N. J.

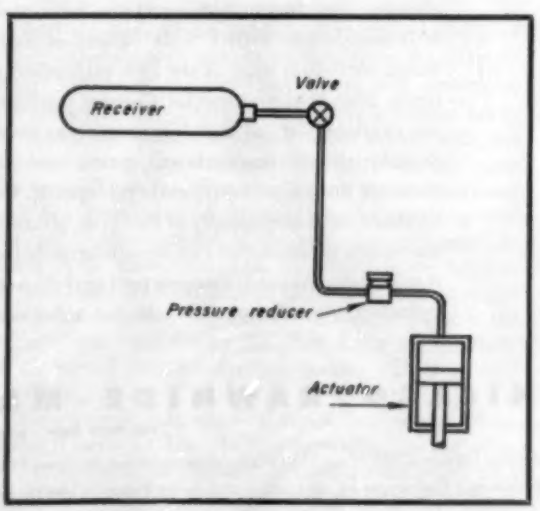

FIG. 1. DIAGRAM of a basic pneumatic power system used to complete the data shown in the accompanying charts.

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pressure can be stored per unit volume of storage container.

3. A greater mass flow of air will be allowed in small lines without excessive pressure drop.
4. The moisture removal efficiency by mechanical means will be greatly improved.

Regarding the equipment required for the 5000 psi system, at first glance it may seem that the compressor problem would be a very difficult one. Actually, work on 5000 psi compressors has shown that there will be no appreciable weight increase of such a compressor and that the power increase required over a 3000 psi compressor of the same displacement will be only 15 percent. Hence, 5000 psi compressors are now running in the experimental stage and it is possible to produce these in quantity in time to meet the schedule of aircraft which will require them.

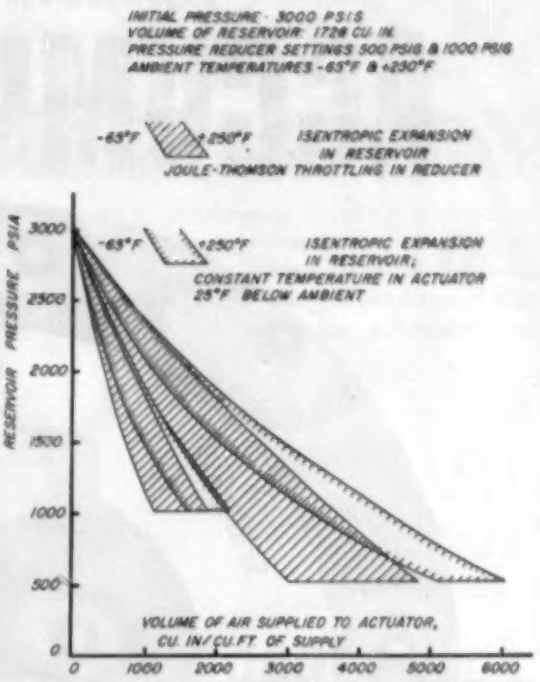
The moisture removal system, by mechanical means, will be greatly improved in efficiency. For example, while the 3000 psi system would remove 99.5 percent of the moisture in saturated air on a theoretical basis —thereby leaving a half of one percent remaining— in the 5000 psi system, the resulting moisture content would be only three-tenths of one percent and the difference makes up a good part of the moisture which is now removed by means of chemical cartridges. In fact, in some specialized applications the need for a chemical cartridge may be eliminated entirely.

As far as the storage reservoirs are concerned, there will be a great reduction in the target area of high pressure air bottles for the same weight of air stored. Furthermore, it seems possible to obtain gunfire restivity without the use of wire or other means which in the 3000 psi bottle have increased the weight of the container. Preliminary analysis shows that the 5000 psi container might well be non-shatterable in itself.

STRUCTURAL MEMBERS FOR AIR STORAGE

In many aircraft, structural members such as landing gear struts, braces and tubular parts can be used as storage members. For such aircraft where structure is available, there will be an appreciable increase in the amount of energy carried because of the fact that the aircraft structure is already capable of holding 5000 psi air and hence two-thirds more air can be carried without any increase in the weight of the storage vessel.

Regarding the energy aspects of the 5000 psi system, it is necessary to study work potential curves. These charts show the relationship of receiver pressure flows into the actuator to do useful work. From Figures 2 and 3, it can be seen that in a system where the same internal storage volume will be available for the higher pressure system as for the 3000 psi system, there will be an increase in the work potential up to 80 percent depending upon the sub-system pressure

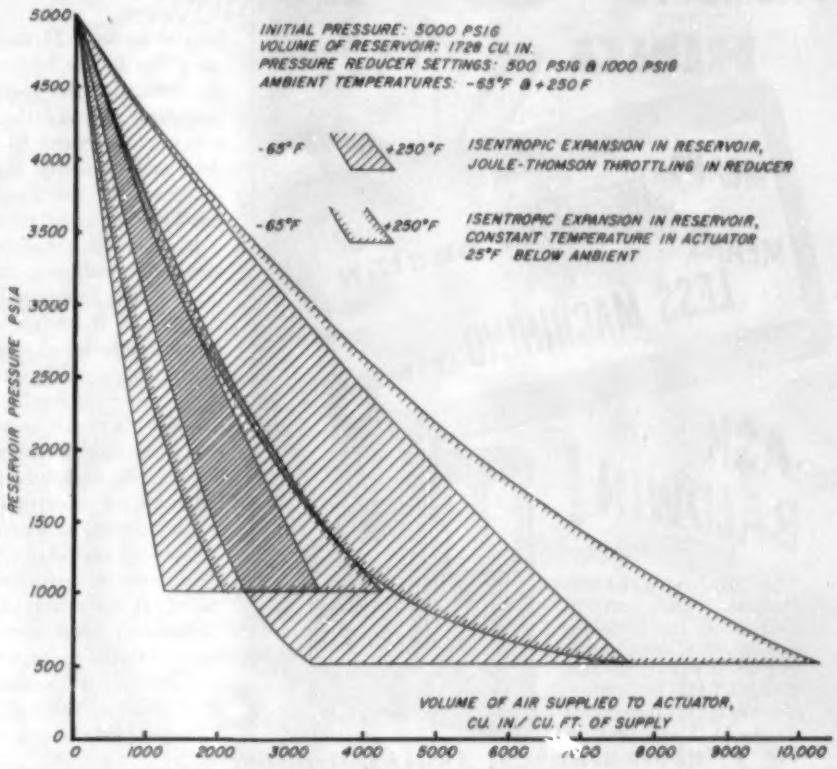


being used and the average temperature of the air in the system at the time of the actuation. Hence, it can be seen that there is a very definite advantage from an energy standpoint in the system where the air storage is accomplished at the higher pressure.

For systems where the air is not stored in the structure of the airplane, but rather is stored in bottles, it is interesting to note the comparison of the 5000 psi system to the 3000 psi when the weight of storage container in each system is the same. This means that the storage container in the 5000 psi system will only have 57 percent* of the internal volume that the container of a 3000 psi system would hold. Figure 4 illustrates such a system.

Figure 2 shows the work potential curves for a 3000 psi storage system and two sub-system pressures; namely, 500 and 1000 psi. The curves shown in cross section show the relationship between the reservoir pressure and the volume of displacement accomplished at the actuator during an instantaneous actuation. These curves assume no heat flow into the system thereby stipulating an isentropic change in the reservoir bottle and no reheating in the lines and in the actuator. It has been found in practice, however, there is an appreciable amount of reheating before the air gets to the working cylinder. Although the degree depends upon the design details of the system, it has been found that in the average system being used today in aircraft pneumatics the air will reheat to

*The 57 percent volume ratio is a function of bottle materials. This figure is based on experience with alloy steel high pressure bottles.



FIGS. 2 and 3. CURVES SHOW the relationship of reservoir pressure and the volume of air supplied to the actuator. They indicate the amount of available work potential for each system. Curves are plotted for two pressure settings of the reducer valve: 500 and 1000 psi. The shaded envelopes show the region into which all curves at different temperatures between –65 and +250 F would fall. In each case, this is done for two different thermodynamic cycles. In Figure 2, the initial reservoir pressure is 3000 psi, in Figure 3 it is 5000 psi. In both cases the reservoirs have the same volumes.

within 25°F. of ambient by the time it reaches the actuating cylinder. Hence, on Figure 2, the shaded curves show the actual work available in the 3000 psi system. The curves are drawn to show an envelope which represents all conditions between –65° and 250°F. The edge of the envelope to the left represents the low temperature condition at +250°F. The ends of these curves represent the condition at which the reservior pressure falls to the sub-system pressure and hence the pressure in the actuator can no longer be held at the designed figure. This condition is used as the end point of the useful part of the expansion curve.

By comparing the shaded and cross-sectional envelopes it can be seen that the effect of reheat in the pneumatic lines and actuator can increase the work available from 15 to 70 percent for the cases investigated in the 3000 psi system.

Figure 4 shows a similar set of curves for the 5000 psi system. Analyzing these on a similar basis it can be seen that the additional work available due to re-

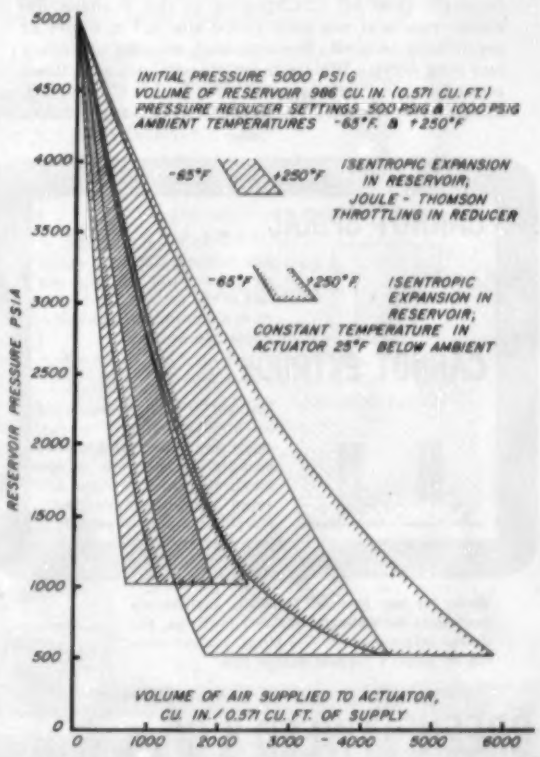


FIG. 4. WHEN THE WEIGHT of the storage container for a 5000 psi and 3000 psi system is the same, the 5000 psi storage container will only have 57 percent of the internal volume of the 3000 psi system. These curves show the work potential for a 5000 psi system as compared to Fig. 2 for the 3000 psi container of the same weight.

heat is between 23 and 130 percent. Hence it can be seen that in the higher pressure system also a great percentage of the energy can be taken from the surrounding air, and the amount of work done at the actuator increased by an appreciable amount. This does not mean that the 5000 psi system of the same bottle weight will yield a greater energy output than the 3000 psi installation.

It should be remembered that in all of the cases of actuation mentioned, the actuation was of high speed; that is, the heat added is that which would be accomplished if the speed of operation of the actuator was in the order of a few seconds or less. For the case where the energy is used over a longer length of time, there is an additional advantage owing to the heat flow into the air in the bottle. In all of the analyses above —even though heat flow was accomplished in the lines and in the actuator—the thermodynamic change in the bottle was isentropic. For cases where the actuation is intermittent, or where it is slow and is accomplished over a long period of time, there would be an additional increase in useful energy over and above the figure stated for the reheat condition.

This very brief discussion of some of the aspects of the 5000 psi system over the 3000 psi case is not exhaustive nor all inclusive. Rather it is presented to show some of the more obvious advantages of using 5000 psi pneumatic systems on aircraft.

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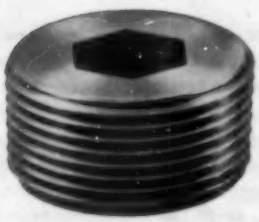

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Aircraft Hydraulic Conference Nov. 3-4

The fourth Transport Aircraft Hydraulic Conference will be held November 3rd and 4th at the Park Shelton Hotel, Detroit, Michigan under the sponsorship of Vickers Incorporated.

Co-chairman of the 1954 conference meetings will be F. T. Blum, hydraulic systems engineer for United Airlines, San Francisco, and R. J. Stapells who is mechanical section chief at Canadair, Montreal.

The 1954 program has been formed of topic suggestions from the airline participants, and is to consist basically of open forum sessions covering transport aircraft hydraulic systems with major emphasis on accessories, tubing, fittings, and hydraulic fluids. During each of the four forums an illustrated technical paper will be presented.

Dwight Moore of Convair will discuss "A Hydraulic System Incorporating a Fixed and a Variable Pump"; E. Pfalman of Boeing Airplane Company speaks on "The Boeing 707 Hydraulic System"; W. Thayer of Douglas Aircraft Company, Incorporated, will present "Hydraulic Aspects of the Douglas Cabin Supercharger, From DC-6 Through DC-7"; and E. Kesselman of the Lockheed Aircraft Corporation is scheduled to discuss "Recent Developments for the Constellation Hydraulic System".

The list of 1954 Conference participants includes representatives of foreign and domestic airlines, foreign and domestic airframe manufacturers, and other aircraft industry organizations in addition to military guests.

The Transport Aircraft Hydraulic Conference was organized in 1951 to permit an open exchange of general information, ideas, problems and selections by users of aircraft hydraulics. The initial conference had R. R. Stark of Eastern Airlines as chairman. The success of the meetings each year has prompted Vickers to continue sponsorship. Chairman for the 1952 Conference was W. E. Spearman of American Airlines; last year the Conference was led by H. K. Pike of National Airlines.

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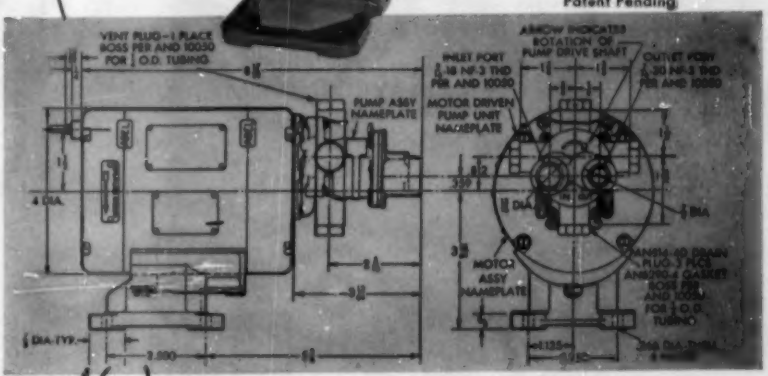

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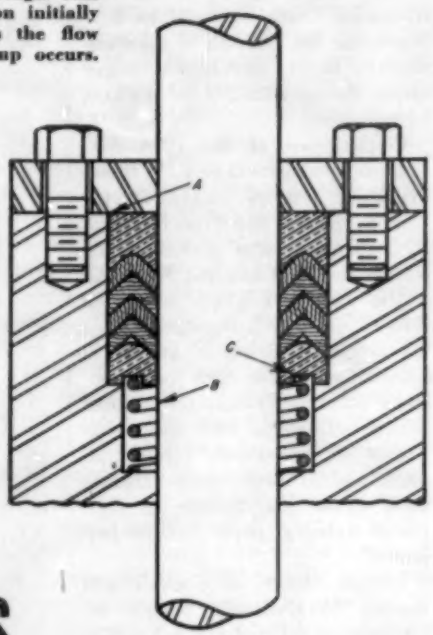
SPRING LOADED Vee design requires a metal-to-metal stop (A) and a coil spring (B) installed on the pressure side of the male adapter. The metal adapters should have an included angle greater than that of the Vee rings. This allows the packaging set to function initially as an expansion packing and aids the flow of the Vees as the automatic takeup occurs.



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SPRING LOADED PACKINGS

By James M. Bradbury

GREATER efficiency and lower overall expense will result from a packing gland which is designed with some consideration given to preventive maintenance as well as initial sealing capacity. Use of a spring loaded design of a Vee packing installation removes the possibility of human error by providing a metal-to-metal stop on the gland. Packing compression does not depend on how much the assembly man tightens the gland. He only brings the gland to a stop without fear of over or under tightening which would result in either decreased packing life caused by excessive friction or excessive leakage. The coil spring on the pressure side of the male adapter automatically expands as wear occurs, compressing the Vees to maintain a continuous seal. This overcomes the problem encountered on some machines where the location of the packing gland makes it difficult for a maintenance man to get at the gland to tighten it as wear occurs.

Since the packing is a flexible, resilient material, the Vees will be expanded so that as wear continues the lips will always be against the rod. The spring takeup enables the Vees to catch the initial pressure. Fluid pressure against the packing lips continues the expansion and sealing.

When using a Vee set without spring loading, the instant the pressure is removed, the packing relaxes and swings back past a norm like a pendulum in a clock. This action traps a little fluid between the first Vee and rod when the pressure is again applied. This, repeated constantly, eventually works up through the set of packings and appears as leakage. With a spring loaded set, the expanding spring stops this pendulum-like movement, keeping the lips of the Vees against the rod at all times.

Spring pressure is of extreme importance—too great compression will create a friction problem, too little reduces sealing efficiency. Naturally, any formula for spring tension will depend on the flexibility of the packing set and rod finishes. Experience in various installations gives this starting point from which to achieve maximum spring efficiency:

Multiply the cross-sectional area of the Vees in inches by 22½ (a ratio based on media compression, atmospheric pressure, plus a safety factor, derived from tests using low-friction leather Vees) to get the total spring force in pounds to be applied against a Vee packing set when the gland is brought down to metal-to-metal stop. Experimentation will then decide the best spring pressure for any individual job.

JAMES M. BRADBURY, sales representative, C. W. Marsh Company, Winchester, Massachusetts

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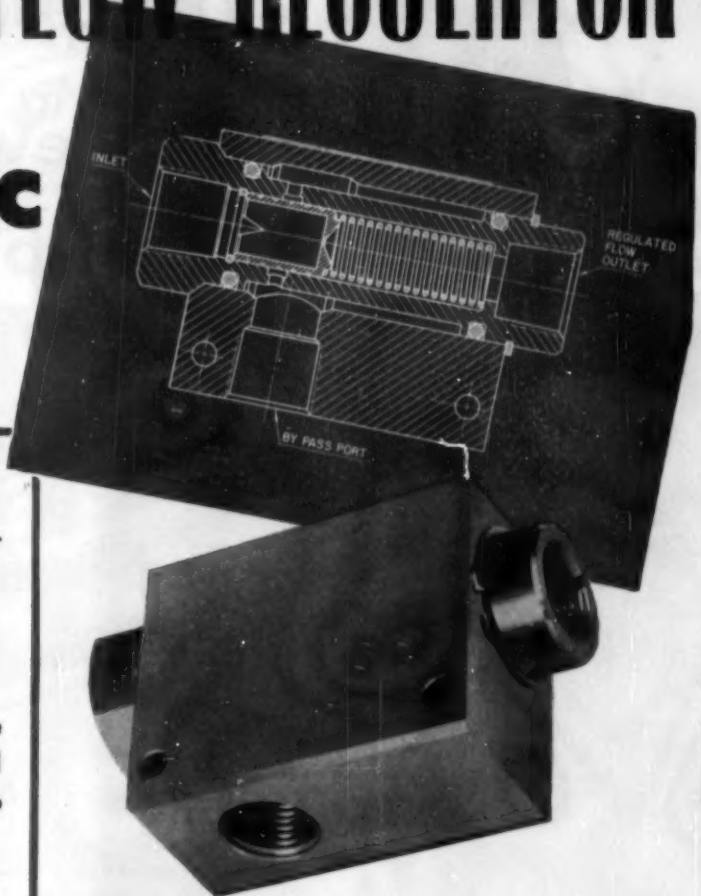

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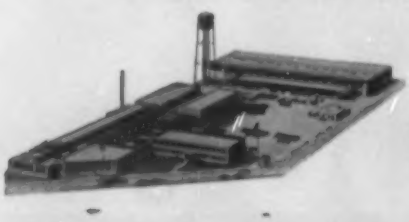

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

CONTROLLED FEEDS AND SPEEDS

. . . give constant chip load

● By Edward Smith

FIG. 1. TOOLS ARE FED in hydraulically at an increasing rate while the workpiece is rotated at an increasing speed. Cam operated deceleration valves change slide speed from rapid traverse to feed.

TURNING operations in the production of jet motor discs shown in Figure 1, require a constant chip load to maintain the required surface finish. To provide this constant chip load as the tools feed across the work from a large to a small diameter, the spindle speed and the tool feed rate must be infinitely variable.

Movement of the tool slides is controlled hydraulically. The spindle which holds the workpiece is driven by a 40 horsepower electric variable speed drive. Using pulley changes, two ranges of spindle speeds provide 12.5 to 92 rpm and 38 to 275 rpm. On the machine shown in Figure 2, the work is rough turned on both sides of the disc, and the step bores and O.D. of the disc are turned. Work is performed by three tool slides which are operated independently from pushbutton stations. After the work is manually clamped and the spindle started, the vertical slide is operated to turn the step bores. The right and left hand slides, having identical power and control circuits, move in to do the contour turning of both sides of the discs.

Automatic changing of the spindle speed and feed rate of the horizontal slides is obtained by the cam arrangement seen in Figure 3. As the cutting tool ap-

EDWARD SMITH, Chief Draftsman, Product Development, The Motch & Merryweather Machinery Company, Cleveland, Ohio

proaches the center, the spindle speed increases and the feed rate must increase to maintain the constant chip load. For this workpiece, the speed must change from 33 rpm at the O.D. to 82 rpm at the I.D. to give the required 200 surface feet per minute.

Both the tool feed and spindle speed cams, Figure 3, are fastened to the moving tool slide. The spindle speed cam positions the follower which causes a signal change to be transmitted from the dancer roll reactor to the electric variable speed spindle drive. Hydraulic feed is regulated by a standard pressure compensated flow control valve which is modified so that a linkage replaces the hand control knob. This linkage is positioned by the follower which acts against the tool feed control cam as the slide moves forward. The flow control valve is arranged in a meter out circuit, Figure 4. As the tool moves in, the metering valve opens wider to increase the speed of the feed cylinder.

Control of the cutting tools to produce the required contour on the workpiece is provided by the slide arrangement shown in Figure 5. The main slide is powered by a 5 inch bore 10¼ inch stroke hydraulic cylinder. There are two smaller slides, which hold the tools, mounted at 45 degrees to the centerline. Movement of the cylinder causes rotation of a pinion as the slide moves forward. The pinion is mounted on a shaft which has a circular cam on each end. The cams are designed to give the desired contour to the workpiece. Each cam acts against the end of a spring loaded plunger which has a rack on the opposite end. This rack engages a pinion on the main slide which is also engaged to drive a rack fastened to the 45 degree tool slide.

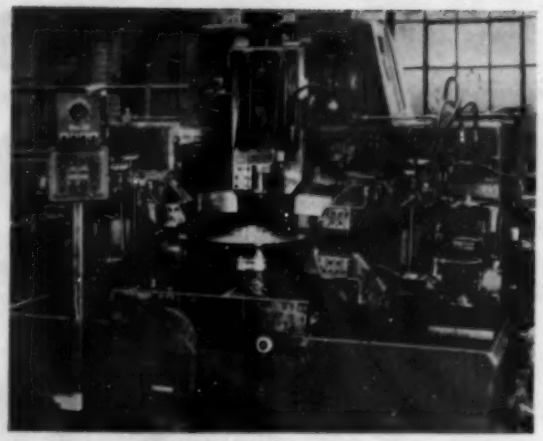

FIG. 2. FROM THE PUSHBUTTON station the operator controls the hydraulic pump motor, the variable speed spindle motor and the control circuits for each of the three tool slides.

All photos and drawings courtesy The Motch & Merryweather Machinery Company.

The main slide traverses rapidly until a cam on the slide closes the deceleration valve to put the slide into feed. At the end of the feed stroke, a 1½ inch bore, 1 inch stroke relieving cylinder, Figure 4, moves the circular plate cams away from the spring loaded plungers so that the tools back away from the work to permit rapid slide reversal without the tools touching the work.

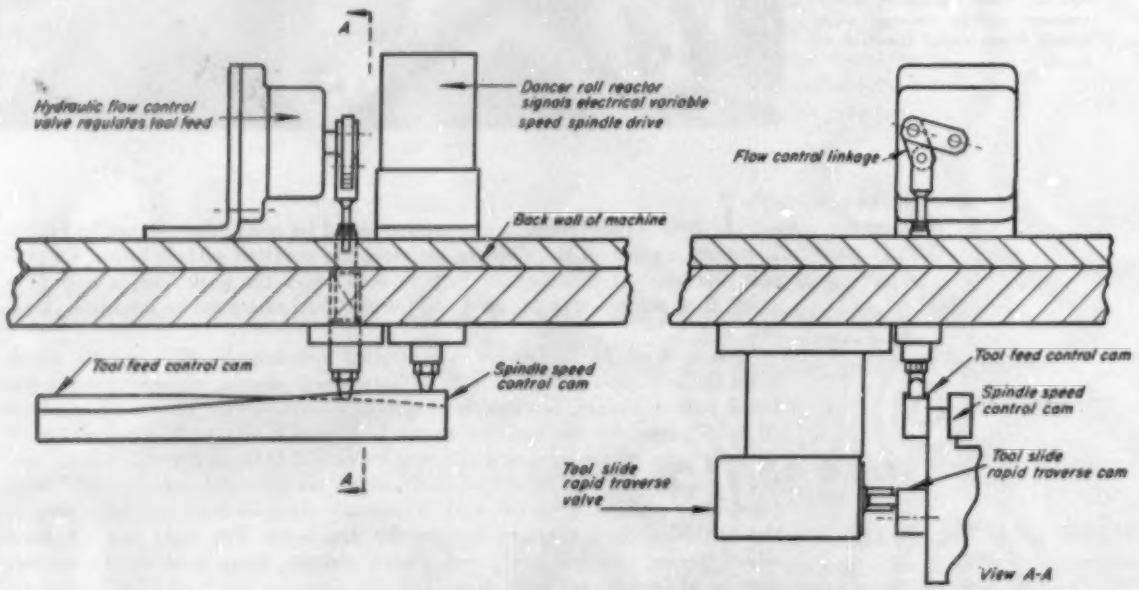
A
Hydraulic flow control valve regulates tool feed
Dancer roll reactor signals electrical variable speed spindle drive
Back wall of machine
Tool feed control cam
Spindle speed control cam
A
Flow control linkage
Tool feed control cam
Spindle speed control cam
Tool slide rapid traverse cam
Tool slide rapid traverse valve
View A-A

FIG. 3. CONTROL OF TOOL FEED and spindle speed as the tools move forward is provided by this arrangement of cams. The cams are mounted to the moving tool slide. Position of the throttling spool in the flow control valve is changed as the control linkage moves in response to changing cam contour. The signaling device for the variable speed spindle drive responds to the follower action against the spindle speed control cam.

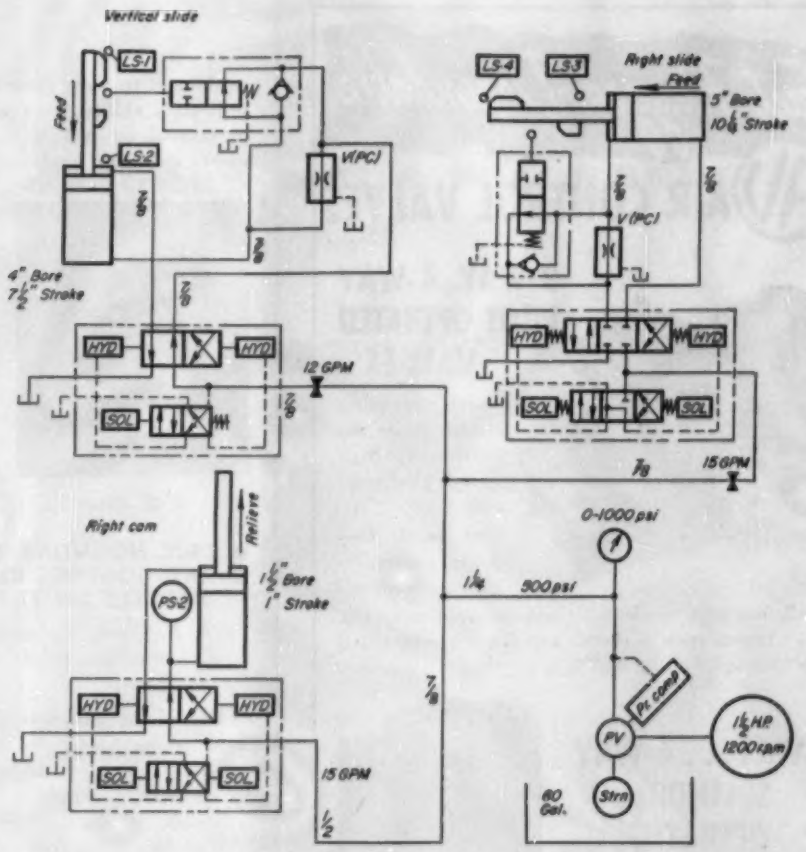

FIG. 4. POWER for the slides is supplied by a 30 gpm variable volume pump. The left horizontal and left relieving cam circuits which are not shown are identical to the right hand circuits. In the action of the vertical slide, a timing relay is energized at the bottom of the slide stroke when LS-2 is tripped, to permit a dwell before reversal. Limit switch LS-4 stops feed travel of the right slide and causes the right cylinder to relieve the tools. With tools relieved, pressure switch PS-2, trips to cause slide reversal. LS-3 is tripped to stop the slide and reset the cam.

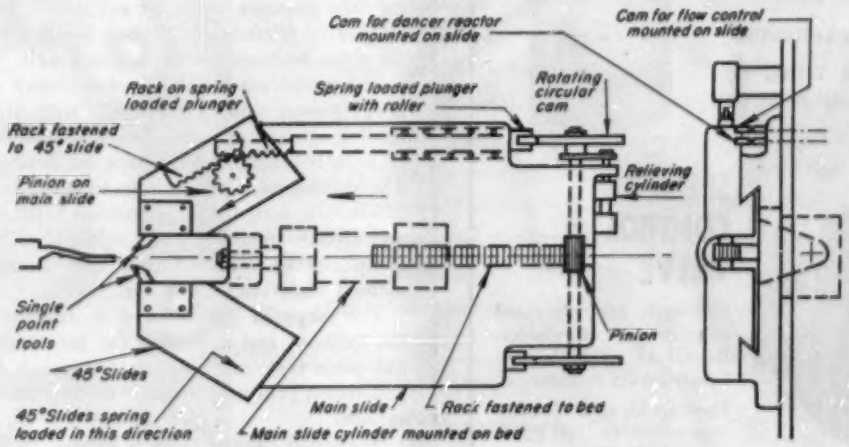
Cam for dancer reactor mounted on slide
Cam for flow control mounted on slide
Rack on spring loaded plunger
Spring loaded plunger with roller
Rotating circular cam
Rack fastened to 45° slide
Pinion on main slide
Relieving cylinder
Single point tools
Pinion
45° Slides
45° Slides spring loaded in this direction
Main slide
Rack fastened to bed
Main slide cylinder mounted on bed

FIG. 5. CONTOUR CONTROL of the workpiece is provided by the rotating circular cams which vary the position of the cutting tool as the main slide moves forward. Movement of the slide causes cam rotation. The cams move the tools, which are set at an angle of 45 degrees to the slide centerline.

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Continued from page 68

equipment to meet these requirements. The lift truck industry's ability to expand in the future depends a great deal on further success of hydraulic developments and their application.

F. G. Cizek

F. C. Schuster

● UNIT MOUNTING OF PUMP AND CONTROL UNITS DIRECTLY ON THE CYLINDER

By F. G. Cizek, Assistant Chief Engineer, American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio

During the past several years the hydraulic press industry has developed and encouraged the use of sub-plate and panel mounted controls as an approach to simplify construction and reduce maintenance of hydraulic presses.

With this same goal in mind, the Elmes Hydraulic Division of the American Steel Foundries designed, developed, and built complete hydraulic presses based on the unit mounted Power and Control Assembly.

High, pressure fluid is conducted through short, direct passages drilled in the structural parts. Since the fluid passages are short and direct, heating of the oil due to friction and turbulence is minimized and the press becomes a more efficient unit.

The pumps used in the pipeless circuit are standard 2-way pumps mounted vertically with drive shaft extending upward and are coupled to standard vertically mounted motors by means of flexible couplings. The shifting of the pumps is accomplished by means of specially designed three position hydraulic cylinders and directly mounted 4-way solenoid pilot valve. The pump can be removed from the mounting bracket without disturbing the motor.

The surge or prefill valve is directly mounted to the cylinder and embodies the decompression valve. Sub-plate type relief valves to govern the pressing and return pressures are also directly mounted on the cylinder.

The speed change valve is flanged to the pull back side of the cylinder and is controlled by means of a solenoid pilot valve directly mounted to the valve body.

Because of the directly connected units, reversal of the press is shockless and response to the electrical control is prompt and precise.

The unit mounted controls reduce assembly and

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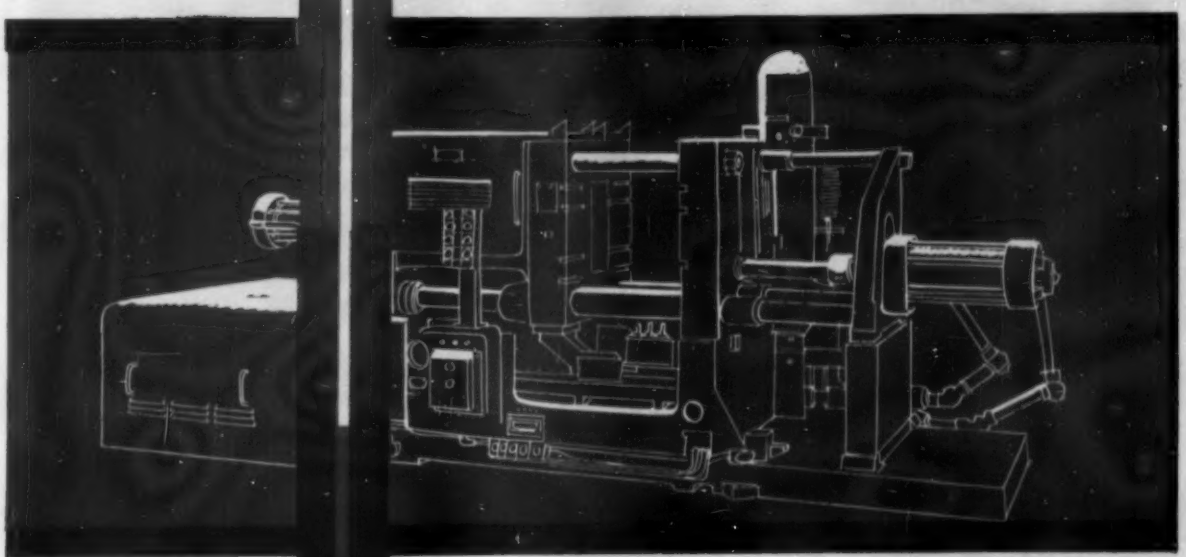

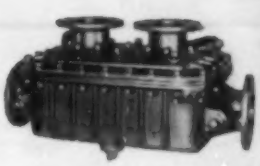

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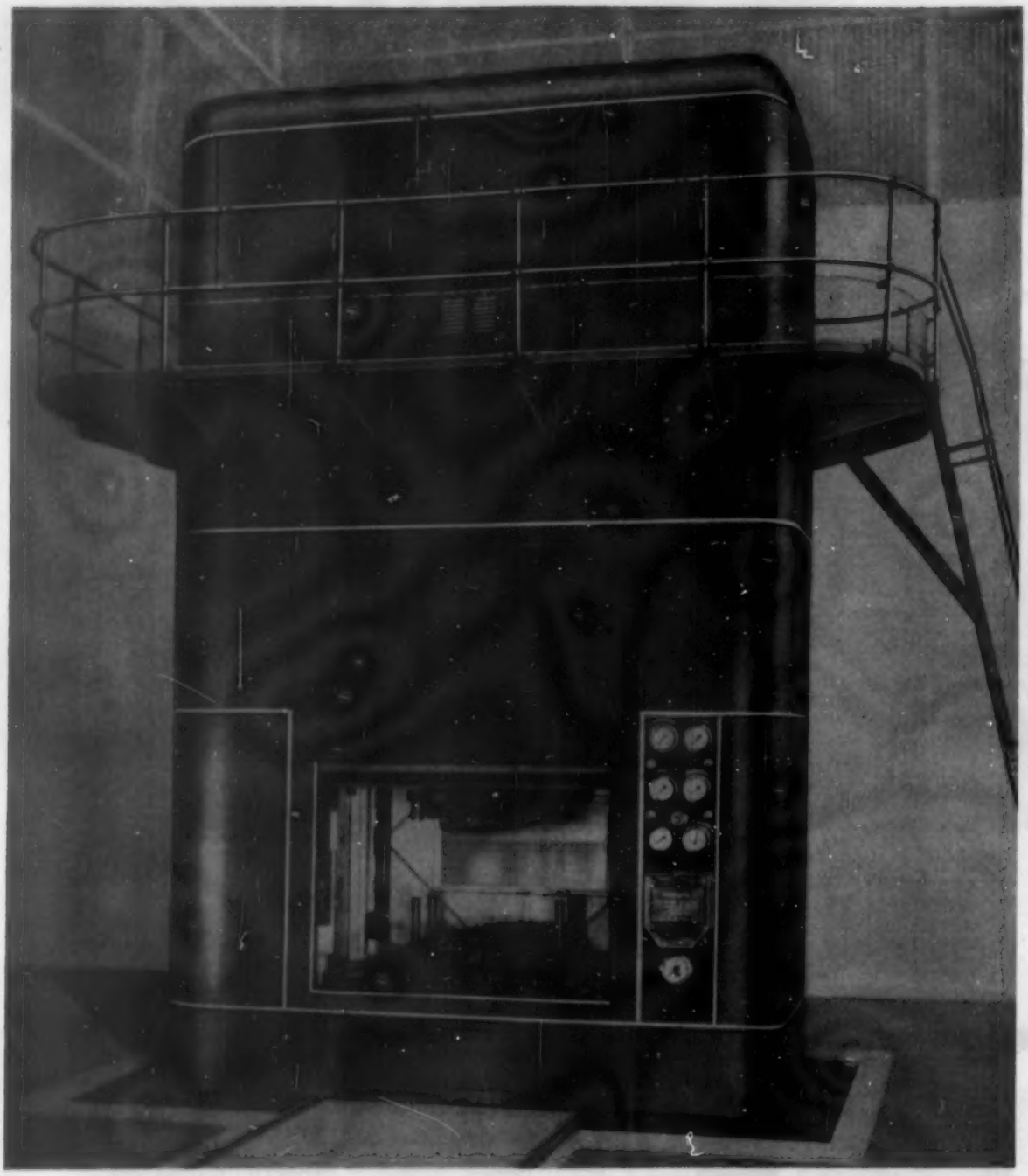

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2"	26.24	27.80	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	32.36	34.12	34.60	35.24	36.36	37.48	38.60	39.72	41.40
3"	35.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	43.96	51.92	53.08	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
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● THE VERSON-WHEELON DIRECT ACTING HYDRAULIC PRESS

By George F. Rohrscheib, Verson Allsteel Press Company, Chicago, Illinois

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This paper will deal with the early history and later development of the Version-Wheelon Direct Acting

The new Verson-Wheelon press in the Hawthorne, Calif., plant of Northrop Aircraft, Inc. The double shuttle arrangement allows continuous production in forming parts for the Scorpion F-89D and Snark B-62 for the U. S. Air Force.

Hydraulic Press, touching briefly upon its adaptability and versatility. The press was developed primarily to produce deeper flanges in heavier gauge parts than was possible by the Rubber Pad forming process (Guerin).

The main theme is the hydraulic circuit, which was designed to eliminate, as much as possible, all shock due to the decompression of the fluid medium. The live nature of the load, the elasticity of the rubber cell into which the fluid is introduced and the natural resiliency of the rubber working pad aggravated the conditions under which decompression was to be accomplished.

The paper will be accompanied by ten photographs which will more clearly illustrate the subject matter. Slides will also be shown for purposes of clarification.

● POWER FOR POWER STEERING

By Eugene S. Witchger, Sales Manager, Pump Division, Eaton Mfg. Company, Detroit, Michigan

The subject of power for power steering involves not only the hydraulic pump flow requirements but also the manner in which this fluid flow is used on the vehicle.

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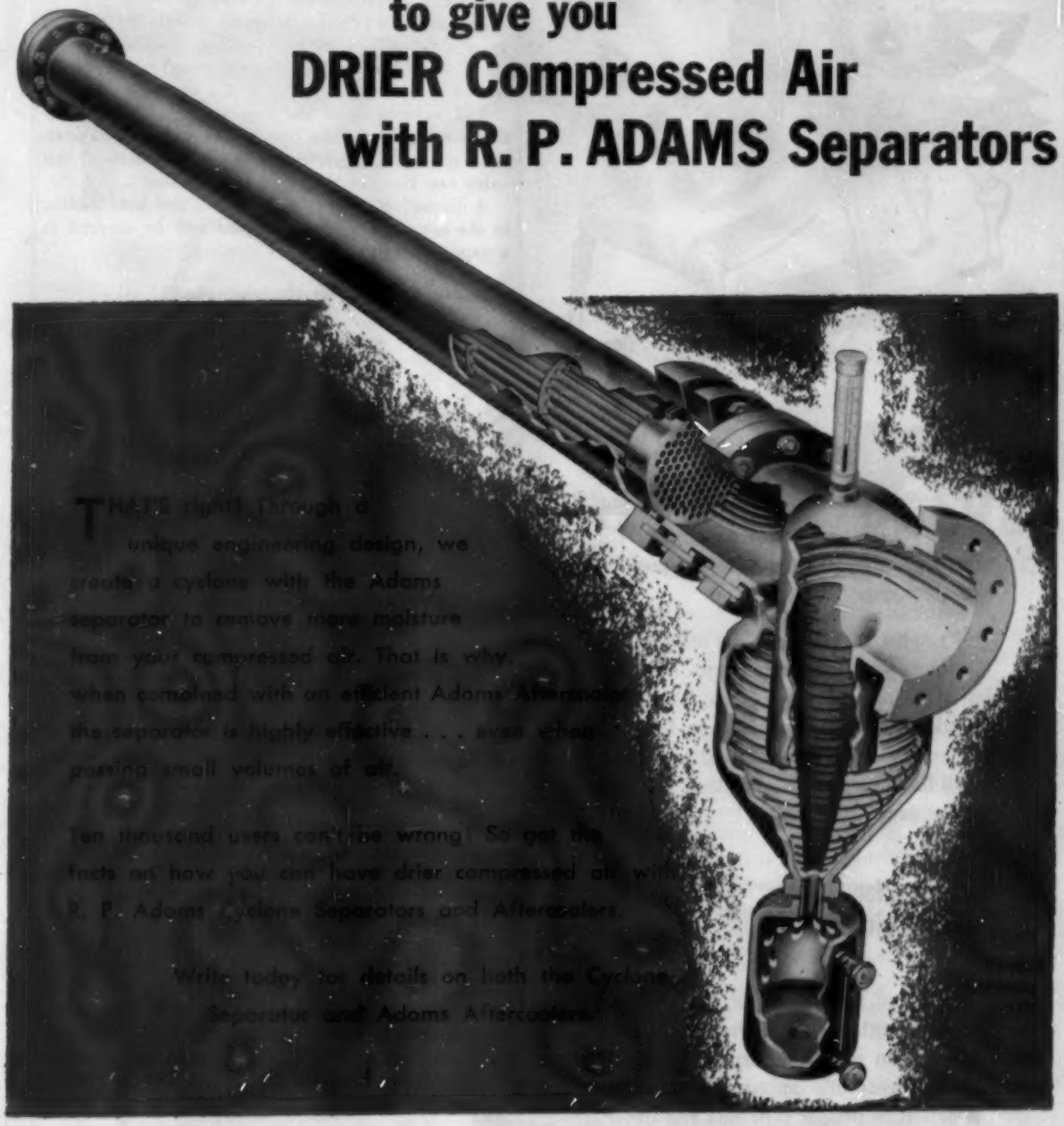

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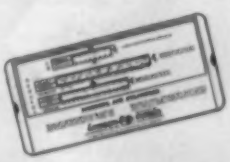

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driving conditions, both as to flow and pressure. Experimental checks show a great variance from the past straight line requirement which has been considered at maximum dry parking pressure.

In order to provide adequate power the steering valve must afford its best sealing condition at the rated maximum desired steering wheel torque as installed in the vehicle.

The advantages of the flow valve in the automotive steering application contributes greatly to its practical operation. The setting and characteristics of this valve can improve the feel of the system.

A discussion of these observations and tests leading to the conclusions in this regard will be covered in a paper on power for power steering.

W. R. Redgers

• CHRYSLER POWERFLITE TRANSMISSION PAPER

By W. R. Rodgers, Supervisor, Mechanical Laboratories, Engineering Division, Chrysler Corporation, Detroit, Mich.

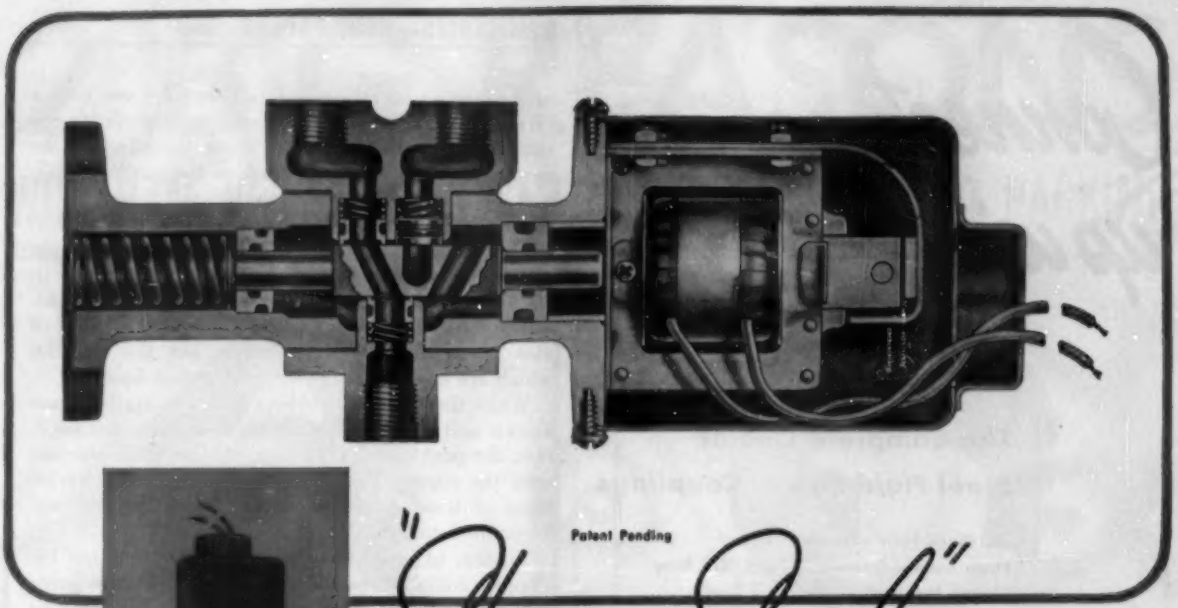
The paper concerns the new Chrysler PowerFlite Automatic Transmission. The transmission consists of a torque converter and 2-speed planetary transmission. The construction of the transmission is unique in that the number of parts and weight are considerably less than competitive units used on similar size cars. The torque converter has the highest torque multiplying ratio of any converter in the field.

The paper deals with the details of the hydraulic control pumps, valve and governor. Some of the performance characteristics of the torque converter are discussed. Some of the testing which went into the development of the cooling means for the converter are discussed in detail together with laboratory stress analysis which went into the design of the housings. Finally, some of the unique control features are described in detail.

• EFFECT OF HYDRAULIC FLUIDS ON SYNTHETICS

By H. C. Crosland, Technical Director, Sirvene Division, Chicago Rawhide Manufacturing Co., Chicago, Illinois

The hydraulics engineer and machine designer has many occasions which he asks himself, "What type



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of packing or gasketing material should I use with a certain hydraulic fluid?" In order to help clarify the situation, this discussion will cover the effect of the various types of hydraulic fluid on the synthetic rubber polymers that are available today.

The types of synthetic polymers will be covered, showing the advantages and disadvantages of using each type, as well as some of the more general applications to which these various polymers are assigned.

The various types of hydraulic fluids available will also be briefly covered, pointing out the qualities which are expected in an ideal hydraulic fluid.

When the synthetic rubbers that are available are known and the hydraulic fluids have been discussed, then the problem of combining the synthetic polymer with the correct fluid can be taken up. The limitations of these combinations are important and will be pointed out.

Finally, in order to more completely help the hydraulics engineer and the machine designer, the paper will be concluded by a discussion covering the type of information a supplier should receive from the engineer to quickly and correctly fill his request for synthetic rubber parts.

J. Wesley Broome

• SERVO CONTROLS AS APPLIED TO VARIABLE DISPLACEMENT PUMPS

By J. Wesley Broome, Section Head, Servomechanisms Dept., Raytheon Manufacturing Co., Inc., Newton, Massachusetts.

Variable displacement pumps are used in industry for the control of machines and processes that require smooth, rapid control of power. In recent years, these machines and processes have become more complicated and require faster, more accurate controls. To meet this demand, the Raytheon Manufacturing Company has designed a series of controls to stroke the Oilgear Variable Displacement Pumps, which, together, form very flexible and reliable servo control systems ranging from ½ to 200 hp. The electro-mechanical components are small, lightweight, reliable, easily mounted, and may be used remotely or locally to the machine or process. A pre-set or program control may easily be provided since the control unit requires only standard electrical connections to other parts of the system. Specifically, the following features may be pointed out:

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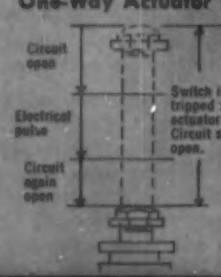

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Power Consumption: The total power required by the system (exclusive of the electric drive motor for the hydraulic pump) is less than 100 watts.

Explosion Proofing: All of the electrical elements required may be mounted in explosion proof housings if required.

Safety Provisions: Two basic fail-safe measures are included. The first one shuts the equipment down in event of power line failure; second shuts the equipment down in case of failure within the control that causes the output to exceed its normal limits. In both cases, the hydraulic pump slide block is automatically set to neutral and the power is removed from the control circuits.

Shock and Vibration: The electric circuits used in this system are essentially free from any effects of vibration and shock which are within the range of those found in industrial locations.

The combination of hydraulic and electric components in this system result in an over-all reliability comparable to that of hydraulic pumps and motors. In addition, this combination provides great versatility of application, simple and inexpensive installation, high accuracy, and rapid response.

• *PROBLEMS ENCOUNTERED IN DEVELOPING A CONSTANT SPEED AUTOMATIC TRANSMISSION FOR AIRCRAFT ALTERNATORS*

By R. G. Doolittle, Group Engineer, Development Engineering Dept., Sundstrand Aviation, Rockford, Illinois

A thorough investigation of various types of electrical systems has revealed that a 400 cycle, 208/120 volt, three phase A-C system is excellently suited for aircraft power. A practical means of generating this form of electrical power consists of driving one or more alternators at a constant speed using main engine power transmitted through an automatically controlled, variable speed ratio, mechanical-hydraulic transmission.

Constant speed transmissions are used in converting the wide range of input speeds from the main aircraft engine to a constant output speed required by the alternator. The governor system senses the transmission output speed and continuously maintains this preselected speed by proper adjustment of the trans-

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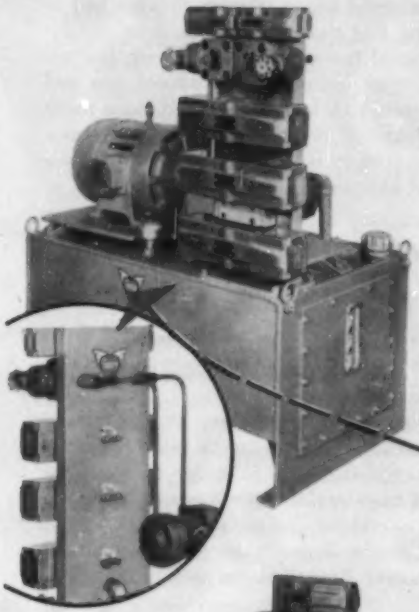

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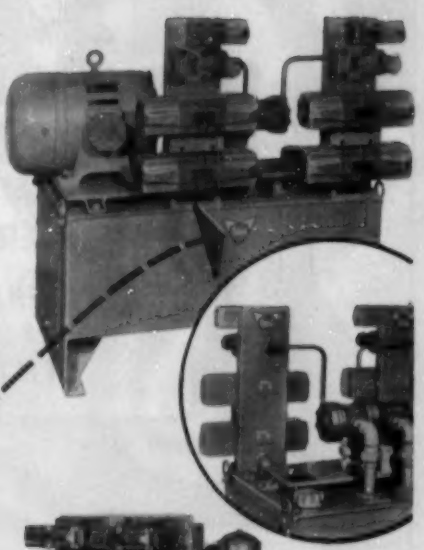
Manifold mounted, if desired, to eliminate excessive piping and possibility of leaks at each joint, assuring virtually no down-time . . . Stand-by valves can be replaced in minutes.



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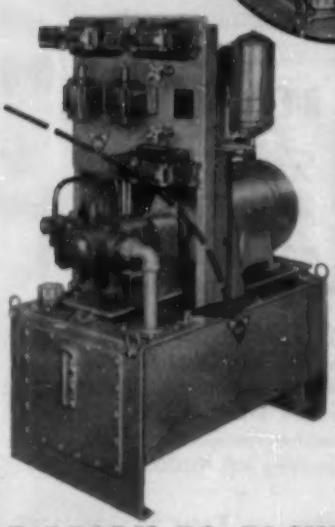

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mission ratio. Where two or more alternators are operated in parallel, the systems must be and are capable of maintaining uniform load division between the alternators.

In the early stages of development numerous problems were encountered and corrective changes had to be made. During this time testing was done on dynamometer powered test stands. Going from the test stands to the aircraft installation introduced new and different problems which had to be solved. As a result of the many hours of flight time logged the transmissions have proven to be an essential and dependable part of the aircraft.

• DEVELOPMENT OF VALVES FOR THE CONTROL OF PNEUMATIC POWER

By S. Y. Lee, Assistant Professor and J. L. Shearer, Assistant Professor, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts

Various considerations pertaining to the relative merits of valve-controlled pneumatic and hydraulic systems are briefly discussed in order to show the potentialities of high performance pneumatic control systems. These considerations include: overall system complexity, efficiency, dynamic performance, availability of fluid power, limitations on working tempera-

S. Y. Lee

J. L. Shearer

ture, lubrication of moving parts, susceptibility to contamination of working fluid, and safety of operation. Key factors in valve design such as size and shape of the metering orifices, quiescent leakage, manufacturing tolerances, stroking forces, overall size, ease of manufacture, and reliability are considered. Illustrations and graphs are employed to describe high performance pneumatic control valves of simplified construction which have been designed and built in the Dynamic Analysis and Control Laboratory at M.I.T.

A typical electropneumatic servomechanism is described and its dynamic performance is shown in terms of steady-state frequency response plots. It is shown that although the speed of response with compressed air as the working fluid is lower than with hydraulic fluid, surprisingly fast response is attainable with air when careful attention is given to system design.

● JET ENGINE CONTROL

By J. M. Eastman, Senior Engineer, Bendix Products Division, Bendix Aviation Corporation, South Bend, Indiana

Since the fuel supply is the main handle for controlling jet engine power, the fuel system is of major interest. Owing to the high moment of inertia of the jet engine rotor, the acceleration from one rpm to another is slow and seriously limits the engine thrust response rate. To obtain maximum engine accelerating rates, fuel flow should be at maximum during acceleration. The maximum fuel flow which the engine can safely burn is limited by 1) the maximum turbine inlet temperature, 2) compressor stall, 3) rich flame-out, and/or 4) maximum compressor pressure. Similarly, a minimum fuel flow must be metered for engine deceleration to avoid lean flame-out. Engine starting, idling, and maximum thrust control problems, and problems associated with after-burning and turboprop engines are briefly discussed.

A typical fuel system and fuel control unit are schematically illustrated and described. Practical problems in its operation are dealt with. General design problems and techniques are discussed. Higher flight speeds cause higher ambient temperatures and raise problems with seals, thermal expansion effects, and increased corrosive tendencies. Higher altitudes and newer engines raise more problems. The main design criteria are performance, reliability, maintainability, ease of manufacture and weight and bulk. The compromise between the conflicting demands of these criteria is not easy.

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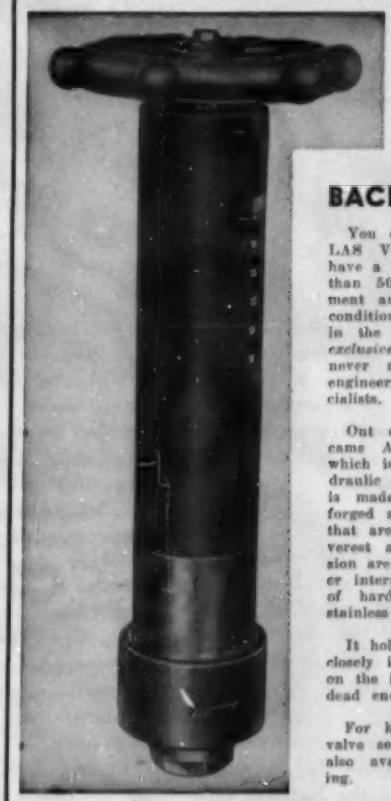

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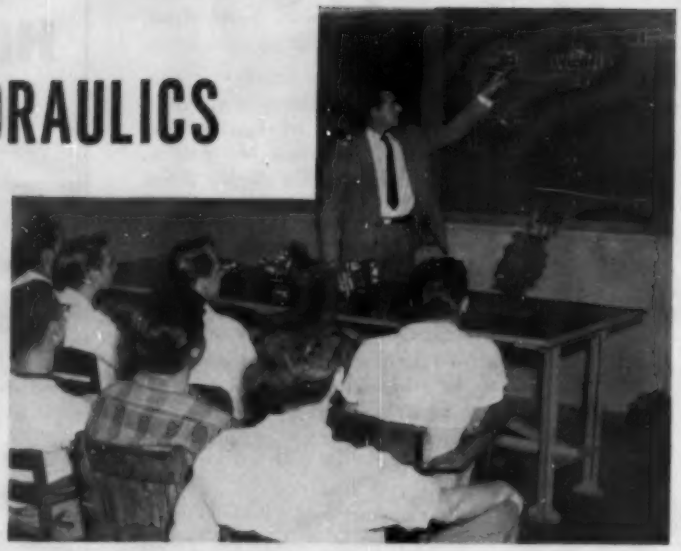
INDUSTRIAL HYDRAULICS TRAINING PROGRAMS



Here's how two companies and one college train men in the fundamentals of oil hydraulics

1. At Illinois Tech

O. E. Teichmann, 1953 *Director of the National Conference on Industrial Hydraulics, tells of problems encountered in the organization and teaching of a new course in industrial hydraulics at the Illinois Institute of Technology.*

THE first course in industrial hydraulics at Illinois Institute of Technology was organized in the fall semester of last year in order to supplement the curriculum for mechanical engineers working in that field.

The course was offered to fill a need expressed by the hydraulics industry during the National Conference on Industrial Hydraulics. It was felt that oil hydraulics has not received adequate attention and that a special course for engineers and working technologists in the field should be set up.

At the outset, it was realized that a completely equipped oil hydraulic laboratory was necessary in order that the students could gain a practical familiarity with the equipment as well as an understanding of basic principles.

Within a few months, the basic units needed were received and installed as the NCIH Hydraulic Laboratory. The 1400 square foot laboratory on the Illinois Tech campus, has been possible through the cooperation of individual sponsors. Working components and circuits, cutaway sections of individual units and accessories and other modern equipment were donated or loaned. The energetic understanding of the hydraulic industry must be credited primarily for the success of the laboratory.

More than 60 students registered for the course, which offered three hours credit. Although no entrance restrictions were set up, a third of the class held bachelor of science degrees in engineering and another third had some college training. The remainder were designers, draftsmen and sales engineers with no college training but men who have had considerable practical experience in oil hydraulics.

The course was broken down into fifteen 3-hour sessions, each session being divided into one hour presentations:

1. Hydraulic fundamental theory;
2. Design and performance of hydraulic components and equipment; and
3. Experimental work in the laboratory combined with exercises in design calculations.

The first period emphasized basic concepts, such as pressure, work, hydraulic and mechanical power, flow resistance in pipes and equipment, efficiency, power loss, heat generation and dissipation, laminar and turbulent flow, viscosity, Reynold's number and similitude and considerations and measurement of noise.

Numerical examples were worked in the classroom and homework was assigned.

Guest speakers were invited for the second period. They lead discussions on such subjects as gear, axial and radial piston types of hydraulic pumps and motors; hydraulic circuits and cylinders; con-

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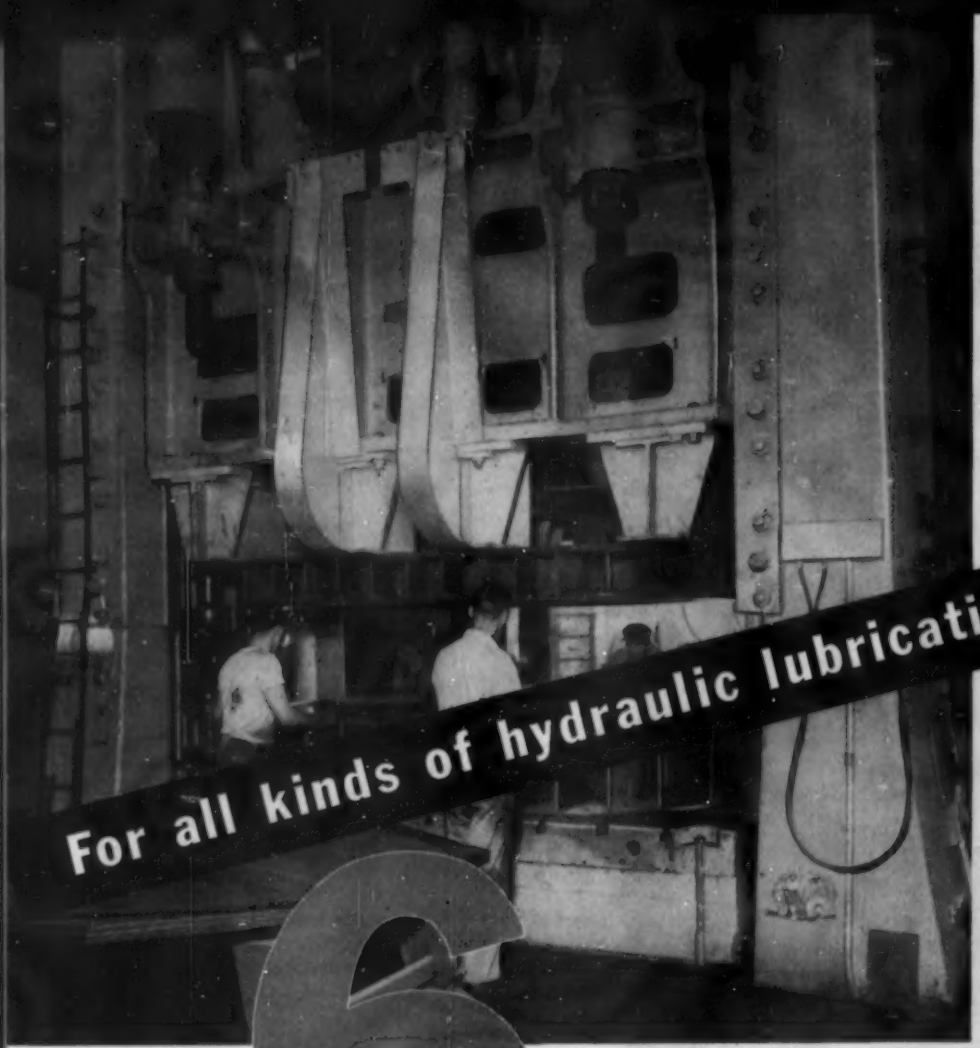

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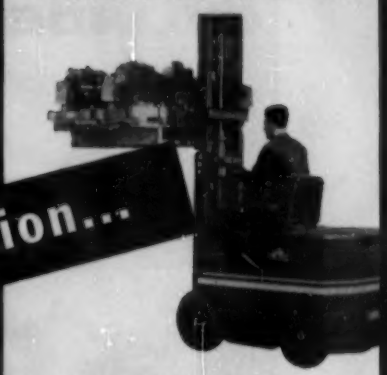

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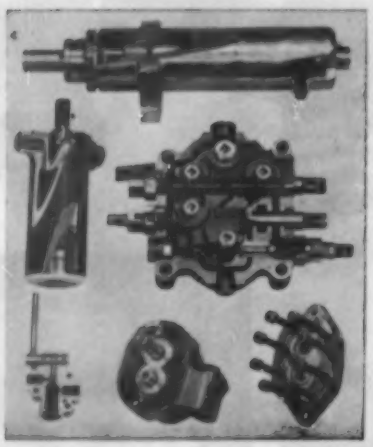

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"HUSCO" welcomes the opportunity to provide engineering assistance on hydraulic problems and in developing new hydraulic equipment

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trol valves, check valves and regulators; measurement of pressure and flow; hydraulic fluids and oils; and applications of hydraulics to the mining, farm equipment, lumber and paper industries.

Representatives from the following companies cooperated in this phase of the training: Aeroquip Corporation, Chicago Rawhide Manufacturing Co., The Denison Engineering Co., Goodman Manufacturing Co., Greer Hydraulics, Inc., Hannifin Corporation, International Harvester Co., The Oilgear Company, The Parker Appliance Co., Pesco Products Division, The Texas Company and Vickers, Incorporated.

During the final period, the class was divided into two groups. One engaged in hydraulic calculations under the guidance of an instructor, the other group went into the laboratory where equipment was demonstrated, its functions explained, and, to a limited extent, performance data taken of units in operation. After a half hour, the two groups changed places.

One problem encountered in adjusting to the varied backgrounds of the students was the choice of a suitable text. This was solved by using two books, "Oil Hydraulic Power and Its Industrial Applications", by Walter Ernst, for the advanced students and the Vickers' manual for the others.

The system of inviting industrial speakers to the classes worked out very well, because each company normally sent their top technical men.

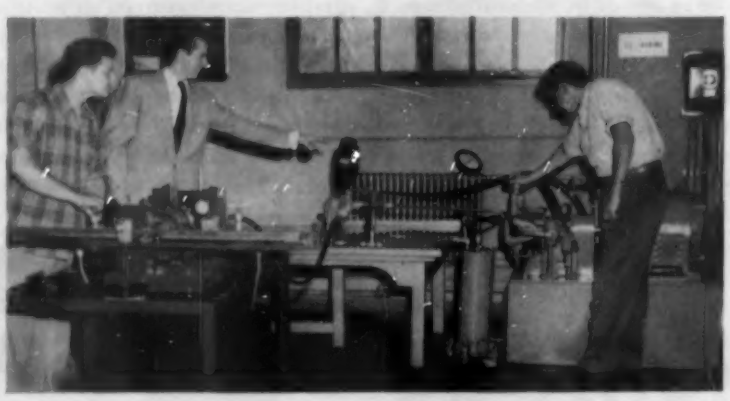
Slides, movies and colored photographs, used extensively by the speakers, were well received because visual aids made it easier for the students to understand the verbal explanations.

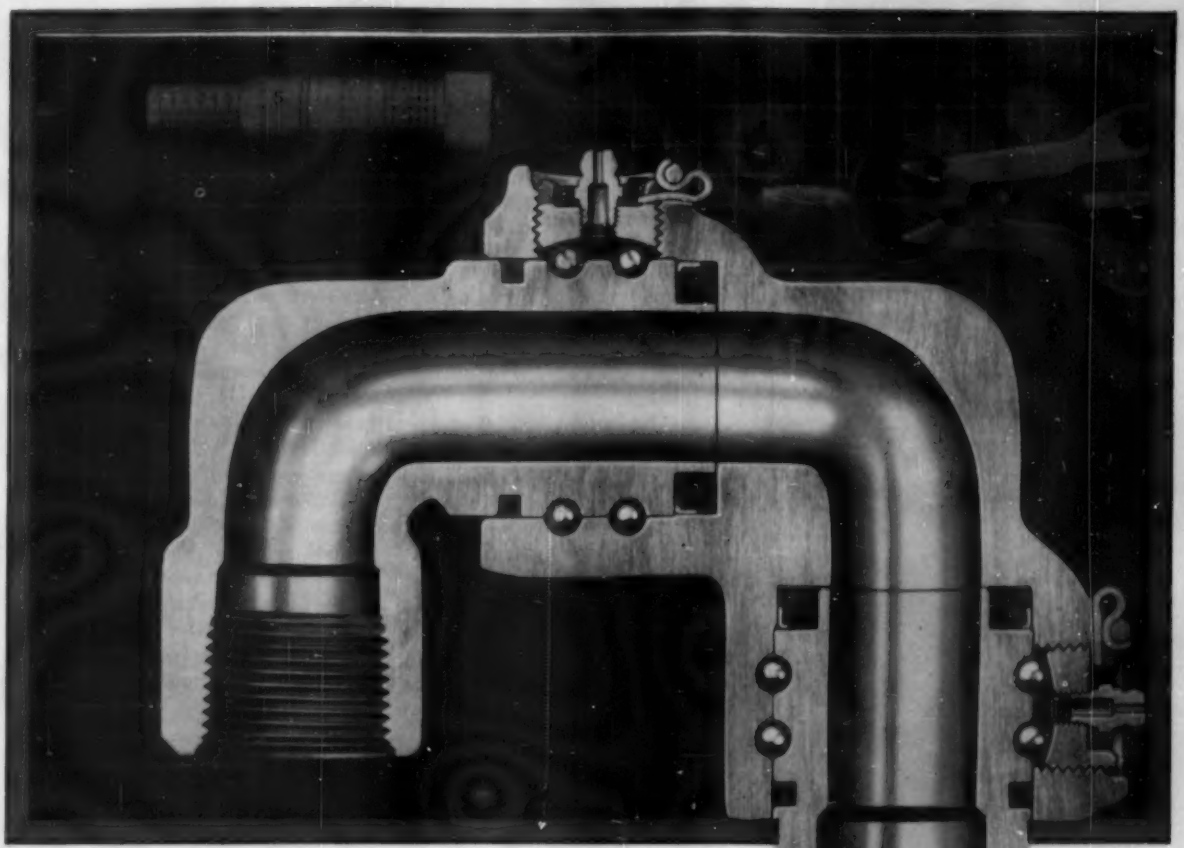
The response from the majority of the students was good and we believe that a sound beginning was made with the initial course. Naturally, there were some shortcomings. The program was overambitious in the attempt to cram theory, application and experimental work all in one short course. Although enthusiasm may be given as an excuse, it is realized now that the student would be better served if the objectives were limited but covered in detail. Hydraulics is a fast growing field in modern technology and the student may get a wrong impression when an attempt is made to present the entire subject in one short course.

The scope of study and laboratory limitations became apparent as the work progressed. These will be avoided in the future.

The laboratory should be capable of handling 30 students, with a minimum of five to eight test places. The laboratory, since it was in the process of being set up during the period of the course, did not meet this desirable situation. However, the best possible use was made of facilities as they became

INSTRUCTOR, Dennis Prosser, points to a test setup in the oil hydraulics lab at Illinois Tech.





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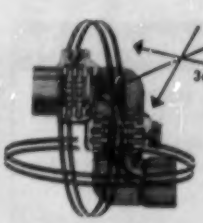

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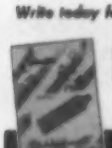

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More specific details on design and construction of the components and performance data of the units would strengthen the educational value of invitational lectures in the future. This type of information especially was appreciated because about half of the class was engaged in some phase of design or testing of equipment.

In the fundamentals of hydraulics sessions, only the most basic material was covered. However, future courses will deal with more specific areas.

For example, a two week full-time intensive short course at the "maintenance" level, "Basic Oil Hydraulics" was offered this summer (June 7 to June 18), eight hours a day, five days a week. The time was divided between lecture, discussion, problems and laboratory. Emphasis was on hydraulic components and their assembly in circuits.

This fall a non-credit evening course, "Introduction to Oil Hydraulic Power" is now meeting. Meeting one evening a week the course will be an improved version of the initial course detailed above.

In the spring we will offer a three credit hour course, "Oil Hydraulic Power". This is at the senior college level and presupposes the usual four mechanics undergraduate courses and mathematics through integral calculus. The course will consist of a two hour lecture and a three hour laboratory session each week. It will inquire into the design factors underlying hydraulic components and circuits.

2. At the Ford Motor Company

THE Ford Motor Company, like every other operator of large groups of high production machines, is vitally concerned in getting the top efficiency possible out of every machine. Each machine must not only be designed to do the exact job assigned to it, it must keep on doing its operations, whether a single or a hundred are involved, week after week and month after month, with an absolute minimum of down time. This means, among other factors, a well trained maintenance staff.

Last year an official of the Ford Motor Company estimated that approximately 85 percent of all production machines purchased for manufacturing and assembly operations were hydraulically operated. This means that proper and adequate hydraulic maintenance is of critical importance in meeting production schedules. For this reason the hydraulic training given in the Central Industrial Relations Training Department and in the training sections of individual Ford plants carries a heavy responsibility.

For the Training Section at Ford's new Cleveland plants—an engine-producing facility and an ultra-modern foundry—this responsibility for training hydraulic equipment specialists involves two major programs.

The first is the standard Ford Industrial Hydraulics Apprenticeship program, consisting of 8,000 hours of shop training and 576 hours of classroom instruction over a four-year period. Nineteen apprentices are currently enrolled.

The second is a "refresher" course for skilled hydraulics men to acquaint them with the new machinery and new maintenance requirements of highly automated plants.

Objective of the apprentice program is to train young men for the relatively new field of industrial hydraulics. The other program, which might be called a post-graduate course, is for men who already know their way around a complicated hydraulic system.

Based primarily on elements of the standard hydraulics apprenticeship courses, this refresher training has the following as its objectives:

(1) To augment previous experience of journeymen;
(2) To give journeymen a clearing house for information

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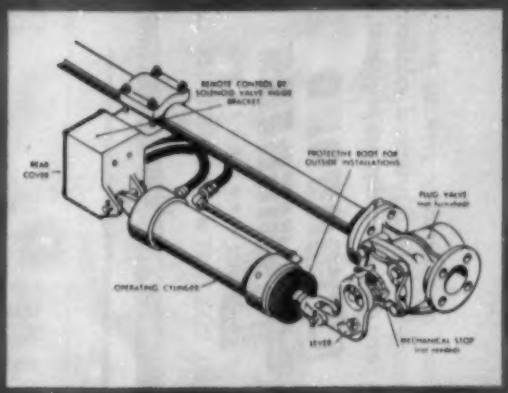

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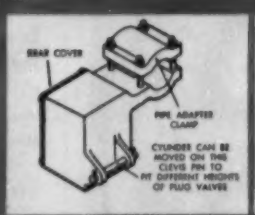

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30 unit map form of Shell Oil Co. in Ventura, California

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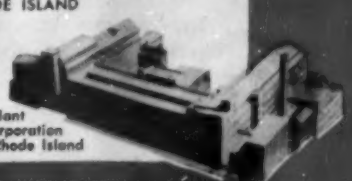

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on specific maintenance and repair problems; and

(3) To develop better maintenance techniques.

All of the hydraulic journeymen in the Cleveland plant are receiving this training. Supervisors also are taking advantage to refresh their knowledge. Periods in the regular training sessions are set aside for discussion of individual or current maintenance and repair problems. In addition, vendor service representatives have been invited to give lectures, demonstrations and conduct question and answer sessions in regard to their equipment. Training is offered weekly to all three shifts. A supervisor in the maintenance department conducts the instruction.

Training materials have been carefully prepared or selected so that a wide range of printed matter, visual aids and examples of components are utilized. The classes of materials include:

(a) Apprenticeship text materials on hydraulics;
(b) Commercial training materials issued by equipment manufacturers and by oil companies;
(c) Films, slides and slide-films;
(d) Cutaway models;
(e) Actual equipment, components and complete circuits; and
(f) Experimental test panel into which malfunctions can be introduced for trouble shooting diagnosis by students.

A practical training area was selected. The Hydraulics Maintenance office and the adjoining Repair area is used. The office is equipped with blackboard and cutaways. Test panel experiments and teardowns of components and circuits are carried on in the repair area. The maintenance office contains about 300 square feet of floor space and the repair area about 700 square feet. The instructor and the trainees decided against the use of a classroom in the general training area in favor of the more central location of the maintenance office and repair area.

The training program for hydraulic journeymen has been unusually successful. Many hourly rated men have been selected for supervisory positions, partly on the basis of their performance in the Training Program. Shop wide confidence in the program is evidenced by the fact that supervisors from other departments have come to the training sessions for information.

The acceptance by the trainees themselves of the advantages of the training has been very gratifying. The enthusiasm of the journeymen has caused them even to hold extra discussion meetings in their own homes between regularly scheduled training sessions.

3. At the Norton Company

TRAINING to fit a definite need has always been the philosophy of the training department of Norton Company, Worcester, Mass., makers of precision grinding machinery and abrasive products. For example, when men in the shop expressed an interest in learning more about the hydraulic controls they were building or installing, the training department set about organizing a specific program to meet their requirements.

That was in 1949. Since then, about two hundred men have received certificates attesting to their completion of the program.

More recently, a customer asked a company representative how he could go about learning the ins and outs of the hydraulic controls on Norton grinding machines. Once again the training department set up a specific program, this time for customers. Still later the customer course was adapted for company supervisors interested in hydraulics.

The earliest courses in hydraulics were designed for men in the plant. They were open to anyone desiring to take the course until the quota for the class was filled. All classes were conducted outside of working hours and attendance was optional.

Absenteeism was negligible. Certificates are awarded to those attending a certain percent of the sessions and a notation is made in the man's record.

ORIGINAL PROGRAM

The program of ten instructional conferences was called "The Fundamentals of Hydraulics and Their Application to Norton Machines". The subjects covered in the first course were:

(1) Fundamental principles
(2) Basic development in pumps, relief valves and control valves
(3) Assembly operations
(4) Circuit diagrams
(5) Automotive standards, strainers, filters, clarifiers
(6) Common hydraulic troubles
(7) Questions and review periods
(8) Talks, demonstrations and movies with invited guests

The interest in the first course was so great that the instruction had to be repeated twice more that year for men of the Grinding Machine Division.

Repairmen and engineers of the Abrasive Division requested a course tailored to their needs. For these men the program contained sessions on presses, materials handling equipment, truck hoists and hydraulic elevators as well as machine control.

Instructors for these courses are usually Norton men who are concerned with the application of hydraulics in their everyday work. For example, Gerard Trottier, who designs hydraulic systems in the engineering department, was asked to prepare and teach the customer course. Working with the training department, he developed a two-week course designed to familiarize customer's maintenance men with the hydraulic equipment used on Norton machines.

Each student receives a folder containing an outline of the course, typical hydraulic circuit drawings, a machine manual and a copy of the JIC Hydraulic Standards for Industrial Equipment.

A typical program for customer maintenance men is as follows:

First Day: Orientation; plant tour of Grinding Machine Division; discussion of course objectives; overall discussion on use of hydrau-

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AND
STILL
CHAMPION
CAN YOU SUPPLY A CHALLENGER?
. . . That difficult fluid, gas, or air transmission problem in your plant—We'll send you a Snap-tite Hi-Flow quick connect disconnect coupling with or without automatic shut-off in any size 1/8" to 3"—Test it in your plant, under actual working conditions—You be the judge—If it doesn't solve your problem or do a better job than the coupling you are now using, ship it back collect—Write today on your letterhead, briefly outlining your problem—We'll ship immediately.
Snap-tite
INC.
201 S. Rockwood, Union City, Penna.

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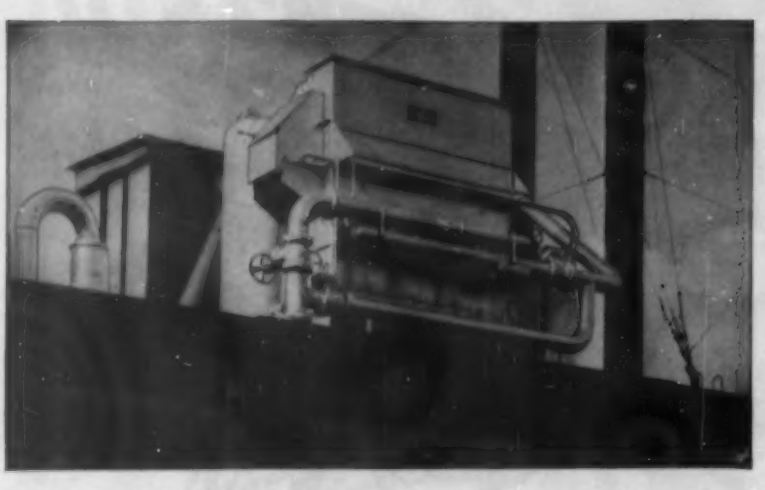

How to Get Drier Compressed Air:

It prevents many troubles and saves much expense

● NIAGARA AERO AFTER COOLER cools compressed air or gas below the temperature of the surrounding atmosphere. Therefore you get no further condensation in your lines. You save much in repairs to pneumatic tools and equipment; you save much interruption to production; you save water damage in paint spraying, in air cleaning, in any process where compressed air comes in contact with your materials or parts in manufacturing (sand blasting, for example).

Niagara Aero After Cooler uses evaporative cooling, saving 95% of your cooling water consumption. This saving quickly returns the cost of the equipment to the owner or makes extra cooling water available for other processes.

The Niagara Aero After Cooler produces compressed air with 30% to 50% less moisture than by ordinary cooling methods. Other Niagara equipment provides bone-dry air for processes requiring it.

If you have an air problem or a cooling problem, a Niagara engineer probably has an answer that will improve your process or save you operating or maintenance expense.

Write for Bulletin 98

NIAGARA BLOWER COMPANY

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TRAINING PROGRAMS

lic controls by Manager of Engineering; and demonstration of cylindrical grinder on the production line.

Second Day: Discussion of Joint Industry Conference (JIC) Hydraulic Standards; Oils; hydraulic pumps and filters; Norton Type CTU manifolds; selector valve and knife edge valve.

Third Day: Discussion of Type CTU table control valve and application of JIC Standards to the hydraulic circuit. Visit to control valve assembly.

Fourth Day: Discussion of Type CTU combination valve and wheel feed cylinder with associated JIC circuits. Visit to table control and combination valve assembly operations.

Fifth Day: General interest tour of Abrasive Division to see grinding wheel manufacturing operations. Discussion of Type CTU table drive cylinders, bleeders, handwheel interlock, wheel head traverse unit and associated JIC circuits. Afternoon visit to sections asembling parts discussed in the morning.

Sixth Day: Discussion of deep shoulder feed and side truing, singly and in combination. Visit to section assembling parts discussed in morning sessions.

Seventh Day: Discussion of wheel guard truing device and automatic sizing equipment. Visit to sections assembling parts discussed in morning session.

Eighth Day: Abrasive Division plant tour. Discussion of Type CTU accelerator mechanism and review of CTU hydraulic system. Review of CTU machine, including run-off of machine.

Ninth Day: Discussion of Norton Universal and Surface grinders covering hydraulic and electric circuits and mechanisms. Observation, assembly and run-off of Universal and Surface grinders.

Tenth Day: Discussion of customer problems and questions; brief discussion of latest grinding machines available. Adjournment at noon.

An important part of the course is the actual practice in solving problems. A machine is intentionally altered so that its hydraulic system will malfunction. The students,

applying information they have learned, locate the troubles and correct them. This "final exam" is one of the most popular parts of the course with the students.

Mr. Trottier reports that the students talk over the problems of the day during the evening and then come in the next morning full of questions. Usually, they try to select a problem that will stump the instructor. They haven't yet, but it usually starts a lively round of discussion.

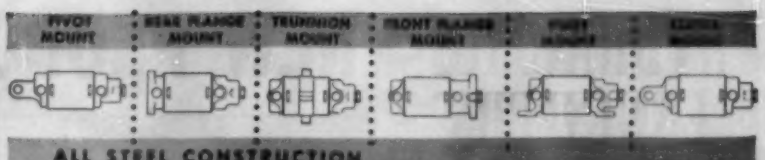
Teaching plant personnel how to use and maintain oil hydraulic machinery can be done in your own plant. This article tells how Ford and Norton train their men. If your operation is too small to warrant an in-plant course, check your local colleges and technical institutes. Many schools are now offering practical courses in industrial hydraulics which may be attended in the evening.

Each customer course is limited to ten men so instruction can be carried on informally. Except for guides used during plant tours, three men carry the instruction load.

Films produced by makers of hydraulic equipment and various government agencies graphically illustrate many of the principles disdiscussed. The printed notes used by each student are retained by him for future reference.

In summarizing the Norton hydraulic training programs, the following seem to be the most important points:

(1) All courses are designed to fit a particular need;
(2) All courses for employees are voluntary and conducted after working hours;
(3) Each course has provision for practical work sessions, locating and correcting difficulties in hydraulic systems;
(4) All notes given students become their property for future reference;
(5) Recognition is given to each student who completes the course by a graduation at which a certificate is awarded, a notation made in his record and by a mention in the monthly company newspaper.



ALL STEEL CONSTRUCTION

rugged, dependable,
SPACE SAVING CYLINDERS
for better design

ONE WEEK DELIVERY

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CYLINDERS
AIR and HYDRAULIC

YOU GET ALL THESE FEATURES

- Full 1 to 1 cartridge rod bearings
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- Available in cup or piston ring construction
- Self-adjusting spring loaded packing
- Heavy wall tubing . . . 6 to 1 safety factor
- Metal rod scraper, milled wrench flats, heavy duty high tensile chrome piston rod . . . all standard on all sizes and types
- 40% less mounting space required
- Cylinders with built in valves and controls

Carter cylinders are the most compact, powerful, dependable and efficient cylinders available. Any product is better and easier to maintain if it's Carter equipped. Carter gives you the most advanced design in the industry. No matter what your application, there is a Carter cylinder to fit your product. Call us in today. You'll be glad you did.

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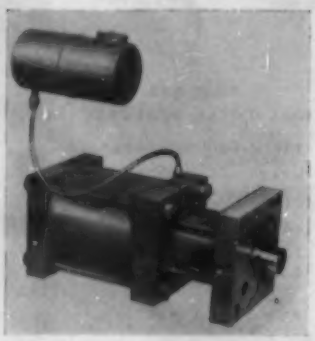
NEW PRODUCTS

Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.

Continued from page 50

PRESSURE BOOSTER
. . . powered by air

Designation: Model D 50
Design: Has a 1″ stroke, attains 5 tons pressure, is suitable for such general production operations as pressing, staking, riveting. Production problems can be simplified by



mounting the power head at various positions.
Specifications: Operates on air pressures up to 150 psi with a ratio of 100 to 1. The ram is 1-¼″ in dia and well adapted to mounting tooling, punches. Can be furnished in varying sizes and capacities, according to customer specifications.

Air-Hydraulics, Inc.
Jackson, Mich.
Circle 194 on Reader Service Card

STRAINER
. . . uses wire mesh basket

Size: Available in nine sizes, ranging in capacity from 6 gpm to 7050 gpm when handling oil of 100 ssu viscosity. Capacity of any size strainer varies according to viscosity of the liquid being handled.
Design: The strainer is cylindrical and is designed for heavy oils and other viscous liquids. The flow of liquid may be in either direction through the strainer, but for greatest efficiency the manufacturer recommends from outside in on the smallest strainer and from inside out on the larger models. The strainer is to a large degree, self-cleaning, because the heavy particles of foreign matter removed from the liquid settle to the bottom of the cylinder, allowing the vertical sides of the wire basket to remain free for continued work.
Application: For suction filters in oil hydraulic circuits.

Wm. W. Nugent & Co., Inc.,
Chicago, Illinois
Circle 195 on Reader Service Card

AIR CYLINDER
. . . with integral control valve

Design: Combines in one compact unit a cylinder, a 4-way valve and a wide variety of valve controls. Now available in bores of 1½″, 2″ and 3″ with any desired stroke.

Only one air connection is required to bring air to the air motor. Air motors can be furnished with or without adjustable cushions at either or both ends of the cylinder. All units have adjustable speed control of the piston rod in both directions. Nine different types of mountings are available. Motors are suitable for air pressure up to 200 psi.
Construction: Valve body is made of high quality bronze. Valve piston is stainless steel. Slide valve is bear-

Continued on page 156

introducing the NEW Model SV

AllenAir Cylinders

WITH BUILT-IN SOLENOID
OR AIR PILOT OPERATED
FOUR-WAY VALVES

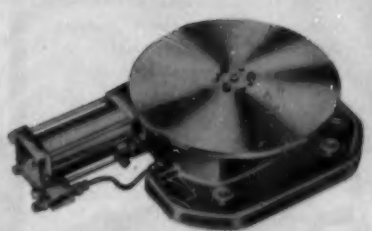
designed for
those investing in
Cylinders & Valves instead
of in the installation,
maintenance and
expensive use of piping

ALLENAIR—THE LOW PRICED QUALITY LINE

CYLINDERS

CLAMPS

VALVES



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The A. K. ALLEN CO.

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LIFT

the efficiency of your hydraulic unit with Roper dependable Pumps. Get optimum performance from the pumps that feature just two moving parts — equal size gears operating in a sturdy case with proper clearance for superior service and long life. The models shown are representative of standard Roper pumps suitable for most applications.

Specify
ROPER
Rotary Pumps
FOR YOUR
HYDRAULIC
APPLICATIONS

LOWER

maintenance costs with a Roper. For instance, a pump like the Series H with pressures to 1000 P.S.I., sizes 10 to 75 G.P.M. is ideally suited for hydraulic mechanisms and for other applications requiring high pressures. Spur gears run in axial hydraulic balance . . . bearings and bronze wear plates reduce friction under heavy loads. Available with packed box or mechanical seal.

PUSH

the unit in your hydraulic circuit with the correct size Roper for the particular job. In many cases the Series K will do, for it is rated from pressures to 150 P.S.I., capacities ¼ to 50 G.P.M. This model is compact, sturdy . . . is self-lubricated by liquid pumped . . . handles total suction lifts up to 25 feet. Comes with packed box or mechanical seal . . . with or without relief valve.

ROPER
Rotary Pumps

GEO. D. ROPER CORPORATION
710 Blackhawk Park Ave., Rockford, Illinois

PULL

favorable comment on a wise choice when you install a Roper as original equipment. Among the dependable Ropers is the Series F Pump —pressures to 300 P.S.I., sizes 1 to 300 G.P.M. It features four-part design with 8 optional piping arrangements . . . supplied in standard or stainless steel fitted models. With packed box or mechanical seal; with or without relief valve.

New Products

Continued

ing bronze sliding on a steel bar stock base which assures freedom from grooving.

Operation: Can be operated either manually or by air or electricity. It can be operated by one of these means in one direction and another of them in the opposite direction. Air operation is by means of poppet or bleeder valves which control the movement of the 4-way slide valve and therefore, control the air motor itself. Valve can be operated electrically utilizing any one of a number of different types of control for the built-in solenoids.

Features: The pistons are hollow and filled with lubricating oil which is sealed in at the factory. This oil is fed out through small radial holes by capillary action to a wick in a groove cut in the od of the piston. This assures a constant film of oil on the inside cylinder wall between the two piston cup seals.

Lehigh Foundries, Inc., Easton, Penn.

Circle 196 on Reader Service Card

LEATHER OIL SEAL . . . operates at 200 F

Designation: National Micro-Torc

Design: Provides extremely low torque, cool operation, no measurable leakage and exceptional life even at 200 F.

Features: Consists of a chrome retained sealing lip coated with a dry lubricant and elastomer material which renders walls of the sealing lip

impervious to lubricants. The coating is slick and smooth to the touch. The center portion of the sealing member retains the natural porosity of leather, thus permitting the sealing member to absorb and store lubricant for use when the normal sup-

ply is exhausted. This feature renders the seals particularly useful for starved or semi-starved sealing applications.

Specifications: The zero leakage performance of the seals is demonstrated in numerous 1000 hour tests which showed that no seals tested leaked as much as .5 grams per day and 90 percent of seals tested had no measurable leakage.

National Motor Bearing Co., Inc., Redwood City, Cal.

Circle 197 on Reader Service Card

ELECTRICAL WIRING BOX . . . for machine controls

Size: Standard sizes

Design: Completely water, oil and dust tight

Features: Manufactured to comply fully with the JIC specifications for electrical pull boxes; there are no ex-

tra holes or knockouts. All conduit holes must be cut in the box; the cover has a neoprene sponge rubber gasket. Cover is fastened to the box by means of an external hinge and clamp arrangement. There are no screw holes in the cover, therefore, no danger of oil leaking into the box; box is mounted by means of external mounting feet, eliminating the necessity of putting holes for bolts through the box; has a removable panel for mounting timers, relays etc.

Hoffman Engineering Corp., Anoka, Minn.

Circle 198 on Reader Service Card

MOTOR CONTROL CENTER . . . saves 50% in floor space

Designation: DA7093

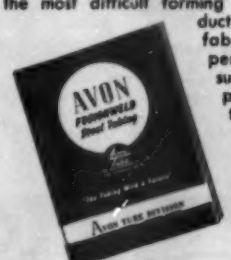
Design: Will take nine NEMA size one starter units, or six NEMA size two units in the standard 90" trough without reduction in pull box space.

Continued on next page

Fusionweld **IS TOUGHER . . .** Avon's own exclusive high frequency resistance welding method produces an entirely new uniformity of grain structure in the welded and adjacent wall area by means of an advanced type of electronic control. This exclusive process combined with our improved cold drawing of larger size tubing into smaller diameters is responsible for the extremely smooth surface finish, closer diameter tolerances and new ease of fabricating.

Fusionweld **HAS A PERFECTED SINGLE WALL CONSTRUCTION . . .** Avon is able to offer thin wall tubing as a highly impressive substitute for costlier tubing—both ferrous and non-ferrous—because of its hi-cycle method of controlled welding. This tubing is available in three tempers—"as welded," "as drawn" and annealed to insure the last word in adaptability to varied tubing uses. It is more economically fabricated—takes tougher bends, beads, flares, etc.—withstands pressures up to 18,000 PSI—has no equal in resisting the severest types of fatigue from vibration.

Fusionweld **IS EASIER TO FABRICATE . . .** Avon's exclusive tube making process has proved itself, matching the most difficult forming operations, with a higher degree of ductility and tensile strength to insure new fabricating ease, lower scrap loss, greater performance reliability. Today our mills are successfully producing over 7½ million feet per month for hundreds of important tubing applications. Our sales engineering staff will gladly assist you . . . or send us your blue prints for tube quotations.



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PLAIN OR TERNE COATED

AVON TUBE DIVISION

HIGBIE MANUFACTURING CO.

ROCHESTER MICHIGAN

Circle 24 on Reader Service Card

Get "packaged" automation

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Modernair

CO-AXIAL AIR/HYDRAULIC CYLINDERS

Give you smoothness and precise control of hydraulic power from your shop air supply – no hydraulic pumps, valves or piping needed.

Complete automation unit . . . automatic models available with built-in controls (remotely operable if desired) of speed, direction, adjustable fast traverse either direction, automatic recycling. Standard models can be remotely controlled with conventional valving and piping.

Compact, self-cooling co-axial design . . . air cylinder surrounds oil cylinder, avoids long, bulky in-line design. Expanding exhaust air cools the oil.

Wide application range; uses standard MODERNAIR cylinder mountings; develops thrust of 3.14 x airline pressure, or 2.7 in pull. Any stroke to 72". Ideal for tool or work piece feeds, and other automatic motions requiring precise speed control.

Modernize your tools now with low cost MODERNAIR Co-Axial Hydraulic cylinders and pneumatic control valves. Cylinders, valves and parts stocked in principal U. S. and Canadian cities. Call your authorized dealer, or write us now for helpful engineering data, specifications and prices.

3

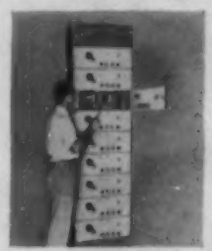
Modernair CORPORATION

Room 10A, 400 Preda St. • San Leandro, Calif.

New Products

Continued

Starter units will be either the fusible or circuit breaker types. Center busing arrangement frees pull box space for wiring and increases vertical bus capacity from 300 to 600 amperes. This same arrangement also



makes available continuous main buses of 600 or 1200 ampere capacity in standard construction up through five sections. The trough is designed to take straight-in wiring to main lugs. Across the hinge wiring to push buttons and indicator lights has been eliminated. Push buttons are mounted on the unit door, and when pressed, actuate the contacts by means of plunger type extensions.

Feature: Newly designed split type "B" terminal blocks allow starter units to be removed or inserted without disturbing established wiring. Terminal connections are made by means of captive screws to ease installation. A new method of grounding has been developed, Cadmium plated gliders, mounted on the underside of each unit, ground the unit to the cadmium plated base upon which it rides.

General Electric, Plainville, Conn.

Circle 199 on Reader Service Card

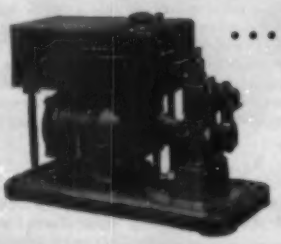
HYDRAULIC TRANSMISSIONS . . . for variable speed

Design: Completely sealed and self-lubricated, these units are designed to avoid constant or close-interval

Continued on page 160

FINNEY HYDRAULICS

. . . meet the requirements of hydraulic engineers

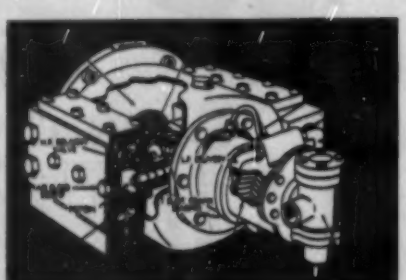


'S' pump of the reciprocating type.

Capacity 65 cubic inches per minute at 5,600 lbs. per square inch. Variable pressure control 1 H.P. MOTOR AT 1,440 R.P.M. Also VALVES TO SUIT ALL REQUIREMENTS.

PRESSURE SWITCH

A new sensitive switch for use with oil, water, and other liquids, Pressure range 400-4,000 psi. Max Micro switch rating 5 amps. at 230 volts AC 3 amps at 28 volts DC. For wide differentials the unit is fitted with two micro switches.



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Oil submerged or enclosed types with Hydraulic pressure control variable from zero to maximum. Pressures up to 7,000 p.s.i. Quantities up to 150 G.P.M.

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AIRWAY PRODUCTS for *Special* HYDRAULIC, PNEUMATIC and MECHANICAL APPLICATIONS

Tubeless tires filled with air, pneumatically

The machine above was designed and built by Airway Products to whip the problem of inflating tubeless tires at a high rate of speed. Many are now being used by automobile manufacturers.

The one above is a single stand model and will inflate 300 tires per hour at 80% efficiency. A double stand model will handle 600 tires per hour. Air pressure ranges are selective and can be set up to 60 pounds.

Tires can be loaded in the machine by hand, conveyor system or by Airway designed automation.

These machines were shipped many weeks prior to delivery date . . . an example of Airway's efficiency in designing and manufacturing special products for industry. If you would like service of this kind, call Airway Products for special hydraulic, pneumatic or mechanical machines and test stands.

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AUTOMOTIVE
COMMERCIAL
DESIGNERS
ENGINEERS
API

Automatic High Production Hydraulic Test Stands

Power steering pump test stand for high speed and low speed delivery. Integral valve is also checked. Test 180 per hr. at 80% efficiency.

Power steering cylinder test stand for proof pressure and leakage. Tests all 1955 power steering units. 180 per hr. at 80% efficiency.

Tests power steering valves for proof pressure and leakage in all operating positions. Tests 180 per hr. at 80% efficiency.

A mechanical automobile seat deflection tester.

AIRWAY FOR HYDRAULIC, PNEUMATIC and MECHANICAL AUTOMATION

FLEX-O-TUBE®

When you specify Flex-O-Tube for flexible lines you get the utmost in *dependability* as well as *bendability*.

Manufacturing facilities are keyed to precise production control. This means you can depend on Flex-O-Tube delivery dates . . . and that's mighty important when you're working against tight production schedules.

Every needed inspection and testing facility is on hand at Flex-O-Tube to safeguard the high quality standards of every product shipped. You can depend on Flex-O-Tube performance.

Dependable, too, is the engineering counsel we gladly extend when you're developing new flexible hose products. This engineering know-how is based on more than twenty years in the business.

If there's a flexible line in your product to conduct air or liquid, that has to be bendable, call in Flex-O-Tube . . . it's dependable.

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

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Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

2527 JIM DALY ROAD • INKSTER, MICHIGAN

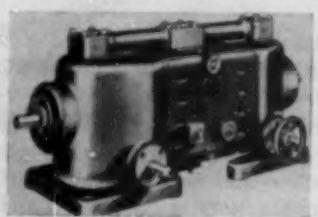
Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

New Products

Continued

maintenance costs incurred by lubrication, adjustment or minor part replacement. They are readily adaptable to synchronization through simple mechanical signals and can be used to advantage on many processing operations where a succession of in-line machines are required. Six basic types of standard adjustable and interchangeable control assemblies can be provided. These include stem, handwheel, cylinder, pressure compensator, servo and electric control.

Features: These package units have variable displacement, axial type pis-



ton pumps and hydraulic motors, and suitable valves and controls enclosed in a bolted cast iron housing assembly.

Applications: Ideal for applications to machine drives on pads, tentering frames, dye becks and other textile equipment requiring accurately controlled variable speeds. Can be run constantly at any selected speed from 0 to 1000 rpm. No limitations on creep speeds are imposed by either speed selection or length of operation.

Vickers, Inc., Detroit 32, Mich.

Circle 200 on Reader Service Card

HYDRAULIC TRANSMISSION . . . for heavy duty jobs

Designation: Size 5 Heavy Duty

Design: Consists of a 112 gpm variable and reversible delivery axial piston pump and a constant displacement axial piston motor. The transmission is designed for operating pressures to 3000 psi.

Features: Any speed from 0 to 1150 rpm in either direction, accurate control of creeping speeds under

Continued on page 162

Extruded to finished dimensions!

Mullins Koldflo can mass produce steel parts like these with close tolerances . . . smooth surfaces . . . at lower cost

THESE one-piece parts are cold-extruded to precision dimensions, with no machining, grinding, or honing required. Thus, in volume quantities, the Mullins Koldflo* process can produce at far lower cost than other methods.

Mullins Koldflo permits you to design intricate cylindrical parts the way you want them. Design features such as shoulders, recesses, studs, etc., can usually be provided easily.

*Trade Mark

Let us quote on *your* parts . . . simply give us design details and specifications, and your quantity requirements.

Write or call the nearest Mullins office for engineering information. For copy of new booklet "How would you tool-up to make an egg?", write Koldflo Division, Mullins Manufacturing Corporation, Salem, Ohio.

SPECIFICATIONS OF TYPICAL KOLDFLO EXTRUSION
Tractor power steering cylinder, length 16⅝ in. Diameter 2.815 in., held to —.000 + .002 in. Surface finish 60 microinches or better.

Koldflo
DIVISION
MULLINS MANUFACTURING CORPORATION
Salem, Ohio

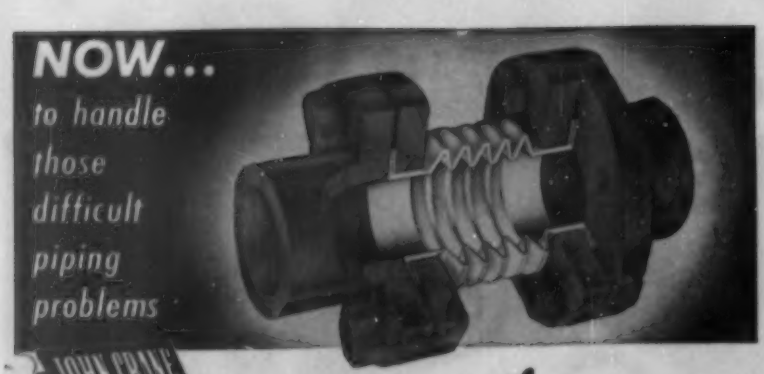
DISTRICT SALES ENGINEERING OFFICES

New York
500 Fifth Avenue
Phone — Pennsylvania 6-2773

Detroit
18268 James Couzens Highway
Phone — Diamond 1-1490

Chicago
332 South Michigan Avenue
Phone — Harrison 7-3725

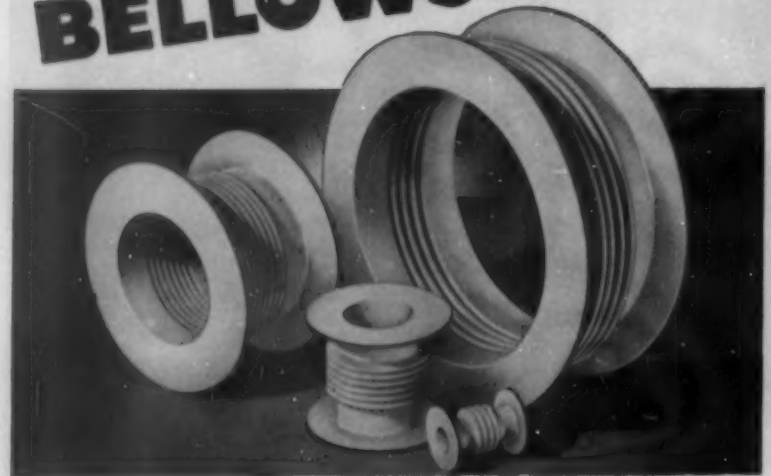
Phone — Edgewood 7-8771



JOHN CRANE

Offers a complete line of

BELLOWS MADE OF TEFLON*



1. **Chemically inert** —*will handle all corrosive liquids, petroleum products, gases and solvents.*
2. **Life-long flexibility** —*will not damage or fatigue under severe vibration or repeated expansion and contraction.*
3. **Outstanding electrochemical properties** —*eliminate electrolysis in the handling of chemicals, acids, etc.*
4. **Wide temperature range** —*flex perfectly and otherwise physically unaffected over a wide temperature range.*

"John Crane" Bellows provide a positive answer in the transmission of any type hydraulic or lubricating fluid, including the newly developed synthetics. Impervious to practically all known corrosive liquids and gases, they are unaffected by temperatures from –300° to +500°F.

Made from a special densely molded stock and so machined that there is no inherent stress at their free length—*they expand and contract in either direction with equal freedom of motion*. End flanges of French-type gasket construction facilitate easy assembly and assure a leak-proof seal. Stock sizes are available in a full range of standard pipe dimensions from 1 to 8 in.

Bellows are also available in a wide range of designs suitable for metering pumps, pressure accumulators, batching scale connectors, etc.

Further information on Teflon parts and products is available in "John Crane's" 12-page illustrated catalog, "The Best in Teflon." Send for your copy now. Crane Packing Company, 1805 Cuyler Ave., Chicago 13, Ill.

In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.

JOHN CRANE CRANE PACKING COMPANY

*DuPont Trademark for tetrafluoroethylene resin.

New Products

Continued

constant load down to 1 rpm, extremely rapid reversals in a fraction of a second, smooth acceleration and deceleration. Overloads to 200 hp, explosion proof.

Application: Being built as a winch and hoist transmission. Other potential and actual applications include drives for wire drawing, chemical processing, heavy machinery. As-

sembled as a packaged unit with all valves and controls built in, including an auxiliary pump, relief and replenishing valves. The pump is servo controlled and has features specially designed for this application, including a constant horsepower device, neutral switch, natural by-pass and a brake control valve. Pump can be separated from hydraulic motor for a considerable distance and can be remotely controlled.

Waterbury Tool, Division of Vickers Inc., Waterbury, Conn.

Circle 201 on Reader Service Card

BACK-UP RINGS . . . made from Teflon

Designation: SR-2619, SR-6144 and SR-7234

Size: .125 to 15.50 in id

Features: Packaged in accordance with latest military specifications. Prevent "O" ring extrusion and re-

duce packing friction to extend the service life and improve the performance of "O" ring seals. By protecting the "O" ring from nibbling

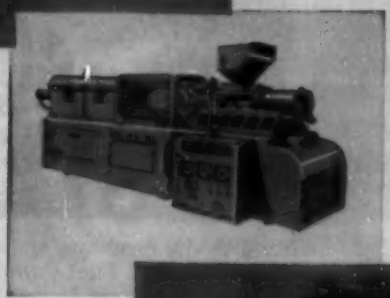
Continued on page 64

'VSG'

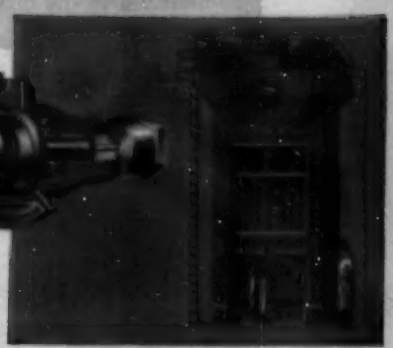
Regd Trade Mark

Infinitely VARIABLE DELIVERY PUMPS

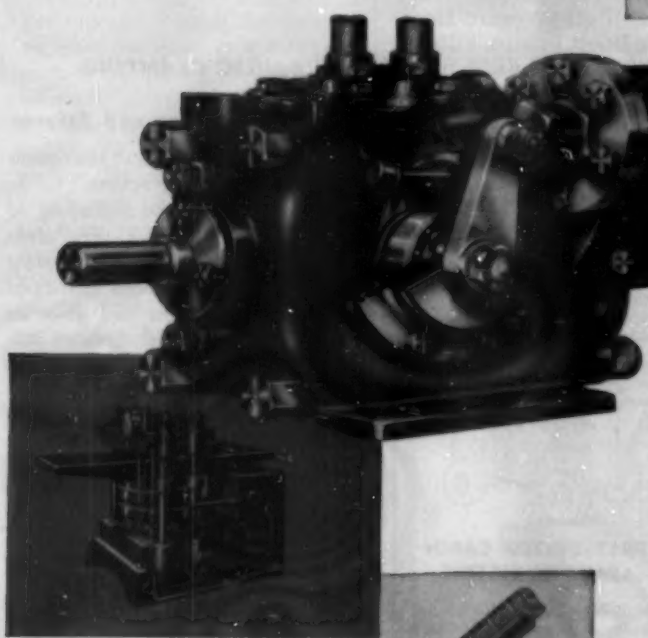
Mobile Manipulator



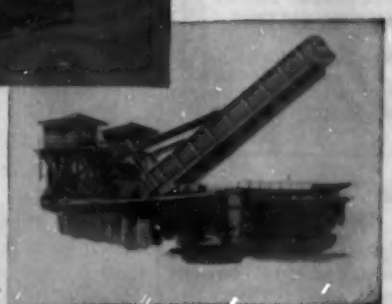
Injection Moulding Machine



Hydraulic Press



Matrix Press



Rolling Lift Bridge

'VSG' Pumps are axial piston pumps of high volumetric efficiency, giving infinitely variable delivery from zero to maximum pump capacity. They are made in seven sizes, delivering from 5 to 360 gallons/min. in three pressure ranges, 1000, 2000, 3000 p.s.i. With the auto pump, as illustrated, delivery is automatically regulated by the pressure in the hydraulic system. The manually controlled variable delivery pump gives constant delivery for any given setting irrespective of pressure variations.

Full details on request from

VICKERS-ARMSTRONGS LTD

VICKERS HOUSE · BROADWAY · LONDON · ENGLAND · *Cables:* VICASTRONG LONDON

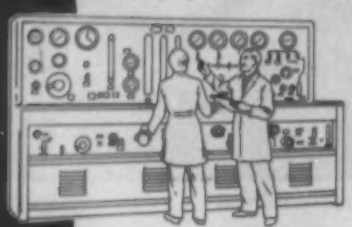
AGENTS IN CANADA: EAST: Consolidated Engines & Machinery Co. Ltd., 5645 Park, Montreal, Quebec and 14th & Birmingham Streets, New Toronto, Ontario. WEST: Galbraith & Salley Ltd., 1331 West 6th Avenue, Vancouver 9.

The Better TEST MACHINES Bear this Trade Mark

When you see the "SPRAGUE" Trade Mark on a test machine, you can be sure of accuracy, efficiency, economy and years of dependable service.

SPRAGUE ENGINEERING & SALES CORPORATION GARDENA, CALIF.

In addition to the machines shown here, SPRAGUE makes Fuel Flow and Fuel Pump Test Stands, Heating and Ventilating Test Units, High Pressure Hose Testers, Air Operated Hydraulic Boost Pumps, Filters, Cylinder type Accumulaters (3,000 and 6,000 psi.), Gage Protector Automatic Shut Off Valves and other equipment. Write for information.



STATIONARY HYDRAULIC TEST STANDS

Tests aircraft hydraulic components, including engine driven pumps, at operating pressures up to 5000 psi. and with flows to 20 gpm. Provides multiple circuits to permit simultaneous testing of several units.

PORTABLE HYDRAULIC TEST STANDS

Standard units, 10 G.P.M. to 40 G.P.M. Motor or engine driven. For complete testing of aircraft hydraulic systems.

PRESSURIZED CABIN LEAKAGE TESTERS

Supply clean, filtered air under controlled pressure to locate leaks and determine leakage rate.

AIR OPERATED OIL DISPENSERS

Dispense clean, filtered oil simply, quickly, economically. One-man operation. Maximum safety.

FUEL BOOST PUMP TEST STANDS

Designed especially to test submerged fuel boost pumps. Tests both A.C. and D.C. types.

SPRAGUE

Engineering and Sales Corp.

1144 W. 135th Street

Gardena, California

New Products

Continued

and preventing spiral failure, they extend the endurance and improve the performance of the rings at higher temperatures and in fluids that have an adverse effect on the "O" ring material. In some applications the back-up rings can seal without "O" rings if the packing completely fills the groove on one continuous spiral of several layers. Chamfered back-up rings are packaged on mandrels and shipped in tubular containers.

W. S. Shamban & Co., Culver City, Cal.

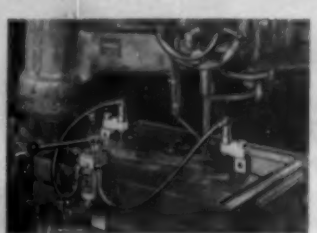
Circle 202 on Reader Service Card

HYDRAULIC CLAMPING SYSTEM

. . . for jigs and fixtures

Designation: Newton Multipoint Hydraulic Clamping System

Design: Loading and unloading of the machined parts is very often greater than the actual processing time. A device has been developed which cuts that time and gives an equal holding pressure. Consists basically of a pump with a number of responsive cylinders. The pump is made in two forms, either a simple screw type, or double acting plunger (lever type).



Feature: Whenever a machining operation takes place the machine part is held in a jig or on the machine bed. This hydraulic package eliminates the necessity of undoing nuts and bolts. A quick turn of a release lever actuates any reasonable number of cylinders. The reverse action is carried out by one or two strokes of the pump.

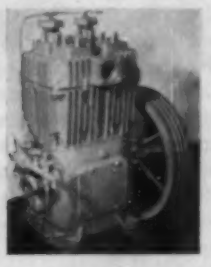
Power Jacks, Ltd., London, England

Circle 203 on Reader Service Card

AIR COMPRESSOR
. . . has dual control

Designation: VD

Design: The most economical compressor operation for both continuous or intermittent air requirements can be selected with the new dual control. When compressed air demand is high, the control is set for continuous compressor operation.



The unloader unloads the compressor when maximum tank pressure is reached. Compressor then idles until additional air is required. For reduced air requirements, the dual control can be set to operate the compressor intermittently. A pressure switch shuts off the compressor motor when required tank pressure is reached; starts it when more air is required. Dual control can be added in the field to any Quincy unit equipped with loadless starting.

Quincy Compressor Co.,
Quincy, Illinois

Circle 204 on Reader Service Card

3-WAY AIR CONTROL VALVE
. . . has instantaneous actuation

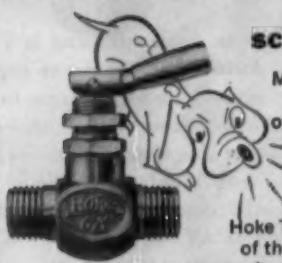
Design: Has full 3/16" passage for actuation of air cylinders and combines small size with extremely compact and rugged construction. Avail-

able in normally closed model, with hand lever, or without the lever for machine mounting and cam actuation, the valve provides instantaneous

Continued on next page

HOKE
Flow Sheet
Hoke reports on fluid control

scientific nose



Motorists in vehicular tunnels throughout the nation may owe their lives—or at least their comfort—to Carbon Monoxide Detection Equipment manufactured by Taller & Cooper, Inc., of Brooklyn, N. Y. Says Stanley A. Kroll, vice-president, "We have always specified Hoke Toggle Valves for our equipment because of the close tolerances to which Hoke products are made. Once a Hoke Valve is placed in the line, no maintenance is required."

If you have a similar toggle valve application, we'll be glad to send you catalog and data sheets, pronto.

water—pure and simple

Pure, demineralized water—whenever you want it. That's the purpose of the Barnstead Pressure Bantam Water Demineralizer, a product of Barnstead Still and Sterilizer Co., of Boston, Mass. An important part of this equipment is a Hoke Needle Valve, chosen because of "its compact size and its precise flow regulation characteristics." Hoke Needle Valves come in sizes 1/8" to 1/2" in aluminum, brass and stainless steel.

triple-threat valve

"We tested many valves for our Infra-Red Gas Analyzer before selecting Hoke," says Max D. Liston, of Liston-Becker Instrument Co. "We had three requirements in mind. First, the valve must withstand corrosive gases and environments; second, it must not leak in the closed position, holding a charge for as long as a year; third, it must fit into a very limited space. So far, Hoke Valves have met all requirements."

Do you have a tough job for a small valve? Why not let us offer our suggestions?

Visit us at Booth #222 & 223 at the Chemical Show

HOKE
HOKE INCORPORATED
Fluid Control Specialists
Circle 89 on Reader Service Card

···AUTO-DIESEL··· IS SET-UP TO SUPPLY QUALITY PISTON RINGS

1 + in SMALL QUANTITIES

2 + give FAST SERVICE

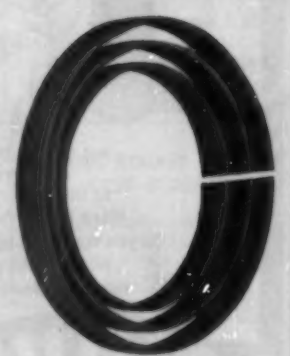
3 + at ATTRACTIVE PRICES

Many firms need piston rings in small runs and in a big hurry. Years ago, in 1921, Auto-Diesel set out to supply this need and as a result several hundred firms in all parts of the country are buying from us on this basis. Our organization specializes in this type of business and have been successfully serving hundreds of firms exclusively. Another important factor is that with efficient operation we are able to sell at ATTRACTIVE PRICES. These piston rings are made up to 35" in diameter for original equipment and for replacement in compressors, hydraulic cylinders, valves, etc. Why not find out about the nature of our service? Many firms, large and small, buy all their piston rings from us.

···THE NEW··· AUTO-DIESEL LONG WEARING GUIDE RINGS

+ for SINGLE ACTING HYDRAULIC CYLINDERS

Auto-Diesel Engineers have developed a new Guide Ring especially for single acting hydraulic cylinders. These rings have been used by enough to justify our confidence. They have proven successful in many plants. They are precision made to give you long and useful service. Auto-Diesel Guide Rings are made of bronze in sizes from 2" up to and including 10" in diameter and in widths from ¼" to 1-½". Why not write for circular and prices.



Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

New Products

Continued

cylinder actuation at a touch. It can operate with equal efficiency in any position. Valve can be mounted or positioned at the most convenient point.

Features: Air connections made to parallel hose nipples at the rear of the valve, keep the lines out of the way and permit more consolidated and simplified piping arrangements when it is mounted on a machine. Requiring but ⅛" movement of the plunger for actuation, the valve provides quick response and return of the cylinder. Valve body is drilled for vertical or horizontal mounting. All internal components are brass or aluminum to make the valve completely rust resistant.

Air-Mite Devices, Inc.
Chicago, Illinois
Circle 205 on Reader Service Card

HOSE COUPLER
. . . Is self sealing

Designation: Hydra-Seal

Construction: Coupler is die cast of extremely high strength corrosion resistant aluminum alloy and has been treated to provide hard wear resistant surfaces.

Operation: To couple, hook on and push together, to uncouple, pull

apart. No tools are needed. As the barrels are hooked over the slide lugs and the coupler pushed together, the barrels displace the slides and the barrel ports are brought into register and alignment-thus allowing the free flow of fluid through the coupler. Pulling the coupler apart brings the slides into position over the ports.

Features: Free flow through the coupler eliminates conventional coupler heating, clogging, pressure drop and power loss. It permits maximum operating efficiency when used in hydraulic, gas vacuum, air, cooling, water, lubrication or material handling problems.

Application: Finds extensive use in industrial applications where unrestricted flow of fluid is desired and quick connect break-away hose coupling is needed.

Char-Lynn Co., Minneapolis, Minn.

Circle 206 on Reader Service Card

OIL LEVEL SIGHT GAGE

. . . has good visibility

Designation: Model 8575

Design: Employs the simplest design yet used. Fewer component parts and maximum visibility at any

height, are featured. Speedy, easy installation is made possible because entire assembly mounts with only two nuts. Can be mounted on heavy wall or thin wall tank. Oil entry is at bottom of gage and air exit at top.

Century Hydraulics, Inc., Detroit 28, Mich.

Circle 207 on Reader Service Card

AIR HOSE

. . . made from braided rayon

Sizes: Standard lengths 50 ft. Sizes ⅜", ½", ⅝", ¾", and 1" two braid.

Design: Made from high tenacity cordura rayon cord which is thor-

oughly impregnated with a rubber cement and braided under tension on steel mandrels. Light, flexible and furnished with a neoprene oil re-

Continued on next page

How G&K-INTERNATIONAL helps R V Jack Corporation build hydraulic jacks that stay put under full load

In principle, the hydraulic jack is quite simple. Oil, drawn from a reservoir into the pump chamber, is forced into the main cylinder, causing a piston to move and operate a load-lifting mechanism.

In practice, the piston head packing has a heavy responsibility. Any leakage around the packing could cause the load to settle.

R V Jack Corporation (Arcade, New York) manufactures automobile jacks. In their 4-ton and 10-ton jobs they were using leather cup packings — and getting leakage. G&K-INTERNATIONAL developed a cup packing with *square shoulders* made of specially impregnated leather (grain outside) and held to extremely close tolerances. *There is no more leakage.*

Working in both leather and synthetic rubber, G&K-INTERNATIONAL can help *you* take full advantage of the best qualities in each material — the best features in standard or special packings designs.

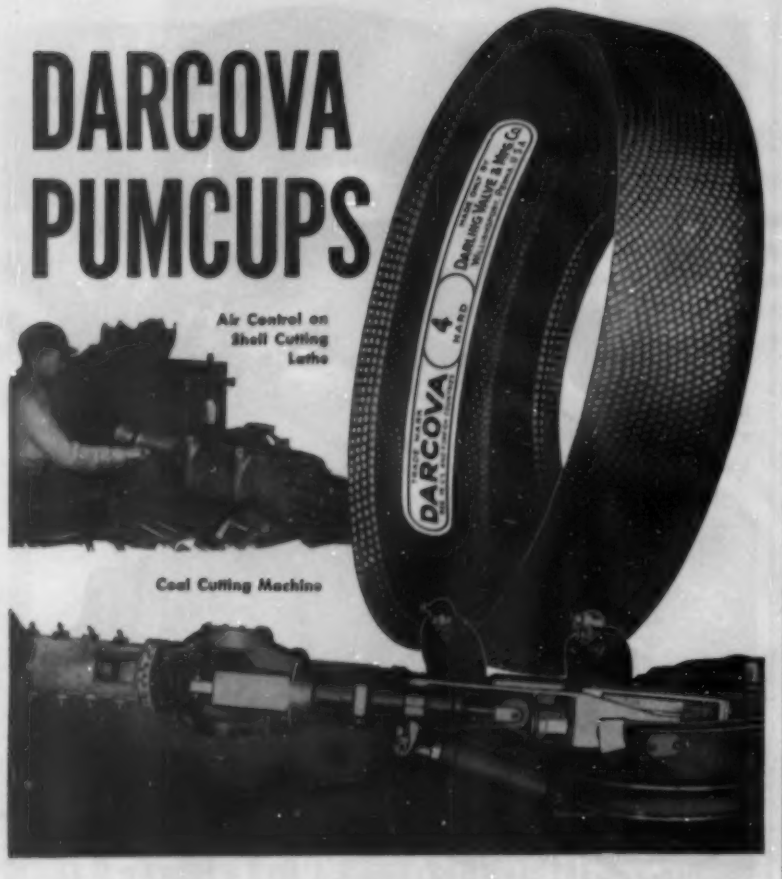
Write for G&K-INTERNATIONAL Catalog and Manual 201-A . . . latest JIC and recommended sizes for cups, flanges, U's, V's, O-Rings, with facts on oil seals and specialties.

G&K-INTERNATIONAL *Packings*

GRATON & KNIGHT — LEATHER — SYNTHETIC RUBBER

GRATON & KNIGHT COMPANY, Worcester, Massachusetts
INTERNATIONAL PACKINGS CORPORATION, Bristol, N. H.

DARCOVA PUMCUPS



The most efficient piston packing for air and hydraulic mechanisms

MORE and more plants are adopting Darcova Pumcups as the standard packing for air and hydraulic cylinders in machine tools, presses, hoists, lifts, rams, pusher mechanisms, controls, regulator valves, spraying equipment and various types of machinery . . . using air, oil, water and other fluids.

There are two basic reasons why Darcova Pumcups have proved to be more efficient: (1) Texture engineered Pumcups outlast most other piston packing at least 3 to 1. (2) Pumcups operate at full efficiency *throughout* their entire life span.

Fewer shutdowns, lower operating costs and longer cylinder life . . . are some of the advantages of Darcova Pumcups. Send for all the facts. Write for Bulletin No. 4502 on Pumcups for air and hydraulic mechanisms.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

PUMCUPS

New Products

Continued

sistant tube. The high quality red cover resists extreme wear, abrasion and severe service conditions.

Specifications: All sizes will stand working pressures up to 300 psi, except the 1" up to 250 psi.

Hamilton Rubber Mfg. Corp., Trenton 3, New Jersey

Circle 208 on Reader Service Card

MIDGET AIR CYLINDER . . . has valve-in-head

Design: Consisting of a 1-⅛" bore and 1" stroke corrosion resistant body and a simple yet sturdy hand lever valve, this new air cylinder is designed for jig and fixture work to fit into minimum space. The elimination of two, out of three, hose lines adds to the versatility of this valve-cylinder unit, as it may be readily connected with any air outlet. With a maximum operating pressure of 160 psi, this unit can replace bulky clamps while exerting enough power for a wide variety of applications.

Rotex Punch Co., Inc., San Leandro, Cal.

Circle 209 on Reader Service Card

POWER FLARE MACHINE . . . for hydraulic tubing

Designation: Power Flare

Sizes: Can be furnished for steel or copper tubing with dies to accommodate ⅜, ½, ⅝, ¾, ⅞, 1-¼ and 1-½ in. Dies are available for 30, 37 or 45 degree angle fittings.

Construction: Has 1/6 hp, 110 volt, 60 cycle motor and may be op-

erated from any convenient light socket. Holes are arranged in plate for ease of mounting on any portable work bench. The clamping surface is 7/8 in long.

Features: Gives a smooth surface for seating, which is always uniform, the metal is not work hardened near the danger point, will roll out many of the defects which may be found in tubing.

Applications: Has been used on all sizes of tubing and wall thicknesses that are likely to be used in hydraulic installations.

Cox Engineering & Sales Co., Detroit 7, Mich.

Circle 210 on Reader Service Card

FILTERS

. . . for non-flammable hydraulic fluids

Features: All models of the sump and line type filters have been adapted for use in the filtration of all types non-flammable hydraulic fluids. No changes have been made in the basic design which provides a balance between maximum active

filtering area and sufficient storage capacity for filtered out particles. Thus, longer periods of production operation are obtained. All of the outstanding features in the filtration of hydraulic oils, coolants and other base liquids in low pressure circulation systems have been retained.

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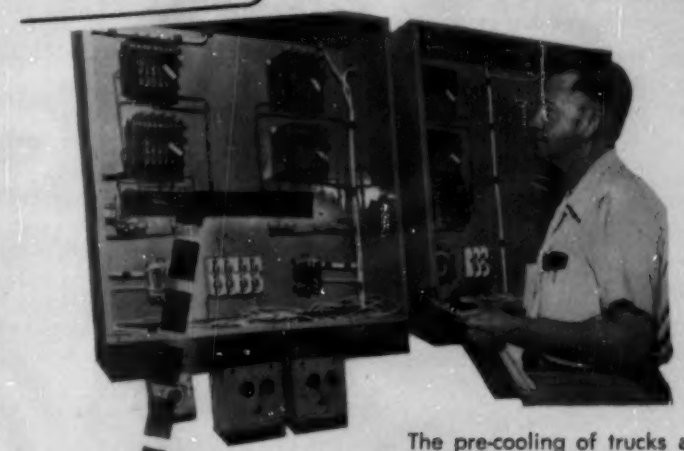
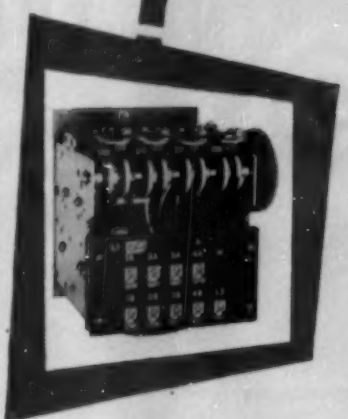
YOU CAN DEPEND ON EAGLE FOR GREATER PROFIT

Automation STARTS WITH EAGLE Timers FOR ANY SIZE INDUSTRY

AUTOMATIC DEFROSTING





The pre-cooling of trucks and railroad cars for the shipment of perishable foods has been greatly simplified by Dr. Phillips, Inc. of Orlando, Florida. Portable pre-cooling units, controlled automatically by Eagle Signal Corporation Polyflex Reset Timers, properly regulate for both high and low humidity conditions. This has increased the operating efficiency by as much as 50%. The Polyflex Reset Timer is only one of many types of reset timers in the Eagle family of timing relays. A timer can be applied to your application — let Eagle engineers go to work for you.

Send for FREE Automation Booklet "See what timing can do for you."

Industrial Timers by EAGLE

EAGLE SIGNAL CORPORATION MOLINE, ILL.

EAGLE TIMERS SAVE TIME, SAVE MONEY

Circle 59 on Reader Service Card

Continued

Available for either sump or line installation in capacities from 5 to 100 gpm. Both types may be easily disassembled, cleaned and reassembled, in a matter of minutes. Line type operates at full efficiency in any position and may be serviced without pipe connections.

Marvel Engineering Co., Chicago 6, Illinois
Circle 211 on Reader Service Card

AIR CYLINDER
. . . has keyed linear motion

Design: Both ports are at the rear of the cylinder which makes more compact installation than possible

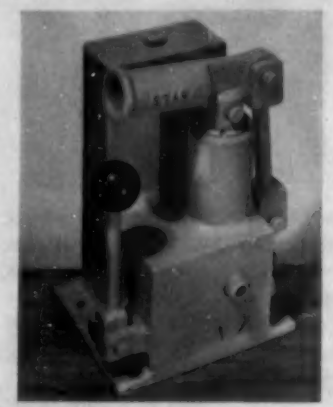
with inlets at each end. Shaft is ⅞" dia at working end and is available with 4" dia flange or with clevis. 2" bore cylinder made in 1" to 6" strokes.

Features: Has double acting non-rotating piston rod that provides perfect registration on each stroke without the use of exterior guides. Useful in positioning work for welding, painting, machining, assembly or where one or more pressure points are required which are not on the axis of the cylinder.

Summit Tool & Mfg. Co., Toledo, Ohio
Circle 212 on Reader Service Card

HYDRAULIC PUMPS
. . . for hand or foot operation

Size: ⅜" in pipe with or without connections for pressure gauges.
Design: Hand and foot operated. Concentric piston two speed construction. Single lever operation with automatic change over from high speed low pressure. Variable speed control release valve.
Construction: All steel with hard chrome plated pump pistons, including dual relief valves. Maximum capacity 10,000 psi. Three sizes with 3 to 1, 6 to 1 and 9 to 1 speed ratio.



Application: All types of remote operated presses-laboratory or field testing machines, elevating tables, production fixture and vises.

Star Jack Company, Inc., River Grove, Illinois
Circle 213 on Reader Service Card

Continued on page 172

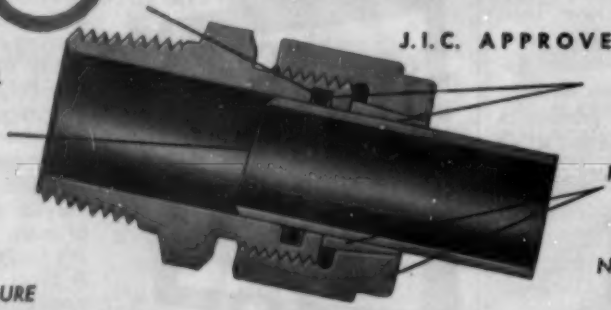
the LENZ "O-RING" TUBE FITTING

J.I.C. APPROVED

NO METAL TO METAL SEAL

NOT NECESSARY TO CUT TUBE SQUARE

NO CONCENTRATION OF STRESSES DUE TO FLARES OR FERRULES FOR TUBE FAILURE



SEAL AND GRIP ARE SEPARATE

HELD BY FRICTION GRIP OF THESE TWO

NO EXACT TUBE LENGTH NECESSARY

DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

A HACKSAW AND A FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. The higher the pressure the tighter the grip. Solve your hydraulic piping problems the easy way . . . with ease of assembly . . . no matching of exact tube lengths . . . simple leakproof connection for the life of the tube.

Reusable collett holds by friction grip up to bursting pressure of tubing.

LENZ FITTINGS MAKE THE JOB AS SIMPLE AS A B C

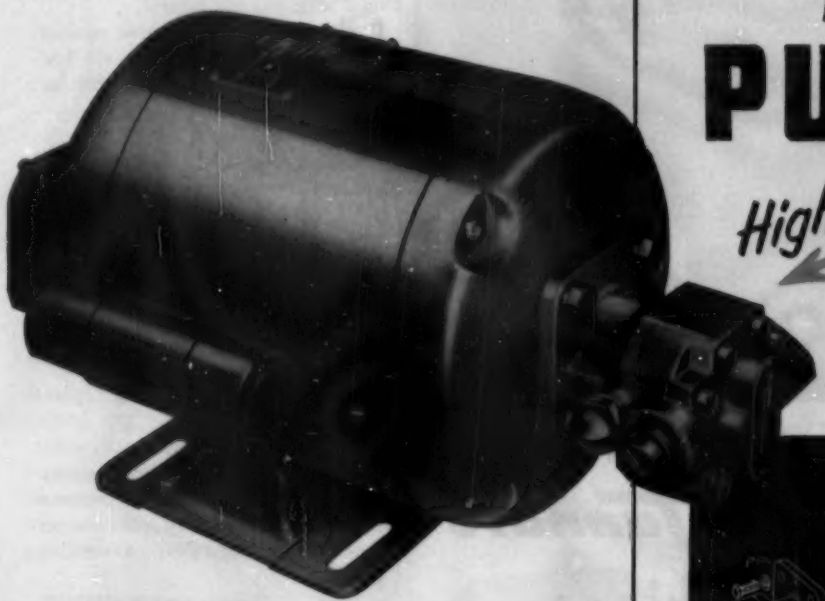
LENZ COMPANY

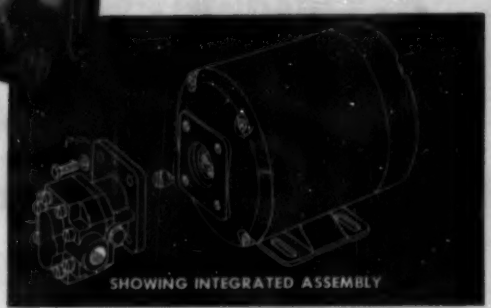
Box 1044-T • Dayton 1, Ohio • ME. 2557 — MI. 7985

BARNES

Constant-Flo MOTOR PUMPS

High Performance! Low Cost!





SHOWING INTEGRATED ASSEMBLY

A "ONE-PIECE" POWER/PUMP UNIT, IDEAL FOR NUMBROUS USES . . .

With pump mounted on bell end of specially-made motor, unit is extremely compact. Motor and pump are "matched". Assembly and alignment are simple and quick. Possible applications: automatic door openers, forced lubrication, filters, material stackers and elevators, crimping machines, vegetable dicers, fuel oil transfer, coolant pumps, chair lifts, and machine tools.

Let us give you complete details.

GENERAL SPECIFICATIONS

Pumps — 12 sizes; ½ to 6 GPM.

Pressures — Up to 1000 PSI continuous service. As high as 3000 PSI in intermittent service.

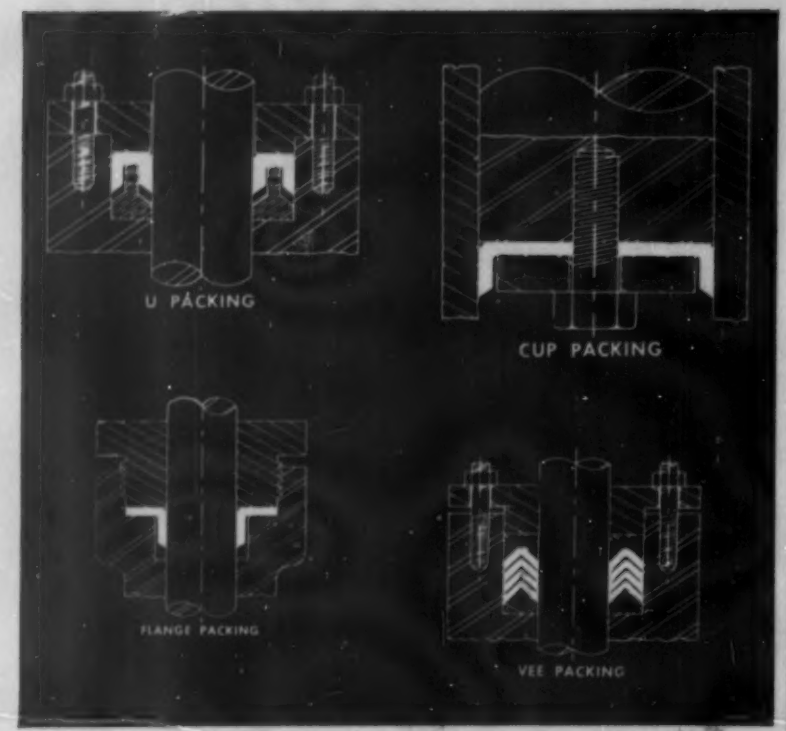
Relief Valves — if desired, 25 to 1500 PSI.

Motors — 6 standard sizes, ¼ to 1½ HP.

EXTREMELY WIDE RANGE OF POSSIBLE COMBINATIONS.

Write for Literature...

JOHN S. BARNES CORPORATION, 305 S. WATER ST., ROCKFORD, ILL.



It's hard to beat these advantages of Tannate Leather Packings

1. They do not require lubrication
2. They do not readily coldflow
3. They will not score or abrade
4. They are adaptable to many different types of service
5. They can be stored indefinitely
6. They are not affected by sub-zero temperatures

You get all these special advantages from Tannate Leather Packings because they are tailor made from special tanned Tannate Leather, custom impregnated to meet your requirements.

If you have a special need for a packing that will seal better and last longer, specify Tannate Leather Packings.

RHOADS
INDUSTRIAL LEATHERS

PHILADELPHIA • NEW YORK • CHICAGO • ATLANTA

New Products

Continued

AUTOMATIC FLOW CONTROL . . . with solenoid valve

Designation: Electro-Mite
Size: ¼ in inlet and ⅜ in outlet. ¼ in bushings are available for outlet. Both inlet and outlet are ¼ in when used with volume control.
Design: Built-in protective strainer provides automatic "on and off" flow control of water or air lines. For use

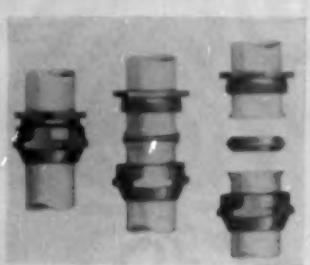
on small flow volume applications. An optional feature is flow volume control, which will maintain one set rate of flow regardless of variable pressure.

Industrial Sales Division, Hays Manufacturing Company, Erie, Penn.

Circle 214 on Reader Service Card

RIGID DUCT CONNECTOR . . . for compressed air systems

Size: Made for tube sizes from 1" to 2-½" in aluminum and in sizes 1" to 4" in stainless steel.



Design: The new design which is furnished in both aluminum and stainless steel, makes possible substantial reductions in size, weight

and number of parts for comparable couplings now in use. It provides a pressure proof, leak proof seal, easily installed and easily disassembled. The connector consists of three parts, the nut, the coupling and insert ring. These three units are easily assembled. The aluminum connector performs satisfactorily in temperatures up to 500 F, fluid or air. The upward limits of temperature of the stainless steel connector are the same as that of the stainless steel tubing used.

Rubber Teck, Inc.,
Gardena, Cal.

Circle 215 on Reader Service Card

For more information on new products use the Reader Service Card, page 117.

INTERVAL TIMER
. . . for accurate cycling

Designation: Type 12 MC

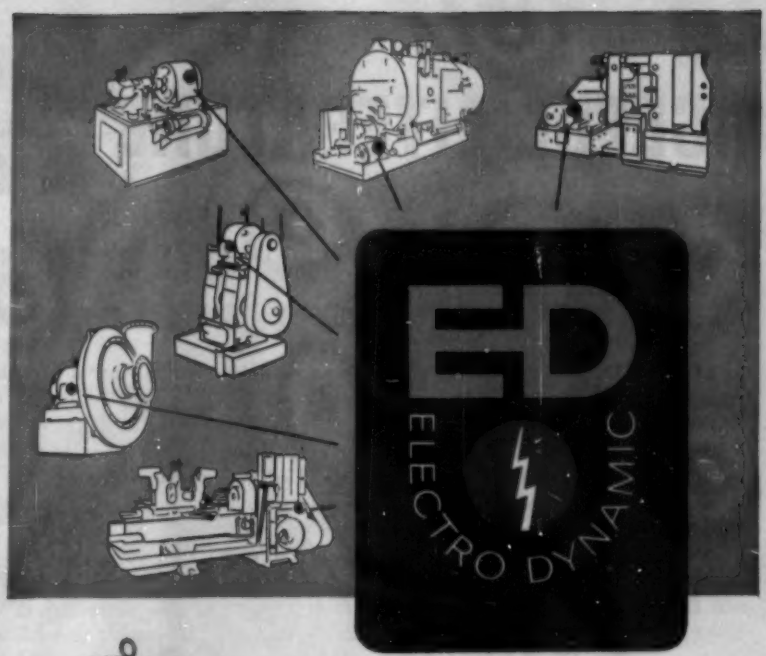
Design: Electronic interval timer, suitable for design into many machines that require dependable and accurate cycling. Timer utilizes an electronic circuit with two filamentless, cold cathode tubes so that warm-up time is eliminated for accurate

timing intervals ranging from .05 to 7 seconds. Duration of the interval is continuously adjustable. Output of the electronic circuit is fed into a simple, single pole, double throw electromagnetic relay with normally open, 10 ampere contacts. Timer requires only .1 watt for operation from any 105/125 volt, 25-400 cycle ac source.

Application: Suitable for push button, foot switch or other actuation of controlled interval operation on pneumatic and hydraulic control circuits.

G. C. Wilson & Co.,
Huntington, West Virginia

Circle 216 on Reader Service Card



THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.

Conclusive evidence of the *extra dependability* of Electro Dynamic motors is now revealed in the new candid report **"MOTOR SHOWDOWN"**. The revealing proof is found in *comparative tests** conducted in accordance with A.I.E.E. standards. Don't miss your copy! Send the coupon below *today*.

*Tests certified by J. Arthur Balmford, Professor of Electrical Engineering at a leading Eastern university.

1 to 250 hp. AC and DC. Standard or special purpose. N.E.M.A. standards.

ELECTRO *xtra* **DYNAMIC** *ependable motors*

ELECTRO DYNAMIC - *Division of General Dynamics Corporation*
170 Avenue A, Bayonne, New Jersey

Please send me a copy of "MOTOR SHOWDOWN" and the new catalog of Electro Dynamic industrial motors.

NAME_____

COMPANY_____

ADDRESS_____

Circle 61 on Reader Service Card

USEFUL LITERATURE

You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation

TUBE BENDING MACHINES . . . either hydraulic or non-hydraulic, for hand and motorised operation is described in a bulletin, released by Chamberlain Industries, Ltd. Various capacity models are available up to 4 in tubes, bent cold and unloaded. The machines are mounted on casters and are therefore movable, allowing the machine to be taken to the work. Several accessories are available for use with the bending machines, including electrical conduit formers and flat bar bending attachment.

Circle 220 on Reader Service Card

DUAL-VANE HYDRAULIC PUMPS . . . identified as PF-100 are presented in bulletin No. DP-302, released by Dudco Division, The New York Air Brake Company. The dual-vane construction provides two independent vanes, in each rotor slot. These individual vanes are hydraulically balanced both axially and radially. The precision ground, chambered edges of the dual vanes, create channels which enable fluid to pass from the vane slots to the tops of the vanes. The pressurized fluid in these side channels acting against the port plates, balances the vanes axially. The vanes are balanced radially through the counter action of opposing thrusts developed by the pressurized fluid acting on the vane ends.

Circle 221 on Reader Service Card

MECHANICAL POWER TRANSMISSION PRODUCTS . . . are described in a new revised 8 page two color catalog B20-53, which is available from Morse Chain Company. The catalog covers silent chains, roller chains, sprockets, cable chains, drive shafts, couplings and clutches. Information is also included in the catalog on taper-lock sprockets, cam clutches and torque limiting clutches. Specifications, stock sizes, applications and descriptions are also shown for each product. The catalog is well illustrated.

Circle 222 on Reader Service Card

FLOW CONTROL VALVES . . . and direct operating pressure controls are described in a new 4 page, three color catalog, released by The Denison Engineering Company. The flow control valve may be quickly reset for more than one application without making changes in spools. It has an adjustable orifice principle which provides a means of adjusting the spool position. Flow controls are supplied with or without built-in check valving and in three sizes, ¼ in, ⅜ in and ¾ in. A complete line of direct operating pressure controls up to 2000 psi are available. Check valves are offered in a variety of types. Pilot operated valves are available in both subplate and threaded body types.

Circle 223 on Reader Service Card

HYDRAULIC WINCH . . . for airborne applications is described in a new 4 page, two color illustrated catalog #A-5225, available from Vickers, Inc. Typical hydraulic winch circuits for single speed and two speed reel operation are shown in schematic diagrams. A typical control system for helicopter installation is included. The winch system components described are nominally 1000 psi hydraulic accessories. Presented also are fully dimensional installation drawings giving complete specifications for the winch system accessories. Included are those for the hydraulic motor driven winch assembly, solenoid operated 4-way valve, automatic two speed valve, hydraulic reservoir assembly and fixed displacement pump.

Circle 224 on Reader Service Card

PIPE MARKERS . . . which are self-sticking and suitable for temperatures up to 300 F or intermittent temperatures to 450 F are described in bulletin No. 135-B, released by W. H. Brady Co. Many markers are available from a stock list including those for air, water and oil usage. The adhesive is resistant to both heat and cold and will stick tight to any pipe or pipe covering over a 600 F temperature range. It is not necessary to brush or spray lacquer over the markers as the overcoating protects the printing and color against dirt, grease and abrasion.

Circle 225 on Reader Service Card

TAPER-LOCK BUSHINGS AND HUBS . . . The bushings are recommended for sheaves, pulleys, flywheels, couplings, sprockets, impellers etc. They provide an easy method of mounting the wheel to the shaft to give what is equivalent to a shrunk-on fit whether the shaft is standard or normally undersize. They also offer convenient means of disassembly and provide interchangeability of various shaft sizes. The hubs are suitable for use in many applications such as for welding to plate steel sprockets. They are made of steel, drilled, tapped and taper bored for taper-lock

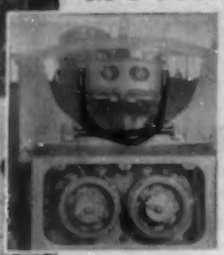
Continued on page 176

Circle 60 on Reader Service Card

PIONEERS IN POWER STEERING

...TURN TO Eastman

PIONEERS IN THE FIELD OF HYDRAULIC HOSE ASSEMBLIES

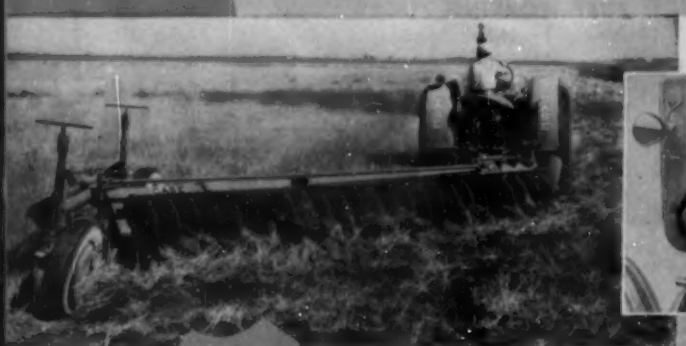


MOVING MOUNTAINS

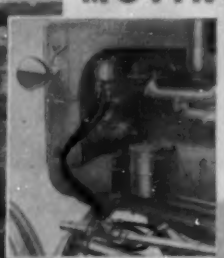
Designers of this great mountain mover were pioneers in the application of hydraulic power in steering this type of earth moving equipment. Thus, *pioneers in power steering turned to pioneers in Hydraulic Hose Assemblies.* Hydraulic power—applied through Eastman Hydraulic Hose Assemblies to the twin brakes, shown here, wheel this International Model 75 "PAYSCRAPER" over rugged mountain terrain.

MOVING FORESTS

Eastman Hydraulic Hose, operating at 2000 lbs. p.s.i., delivers the power required to steer the rear axle, weighing 11,800 lbs., on this New "Hyster" SC-180 model. Due to heavy, load-balancing counter-weight over this axle, it would be impossible to steer this "King of the Lift Trucks" without hydraulic power when empty. Maximum maneuverability is attained through power steering—moving loads up to 9 tons, like these giants of the forest.



MOVING FIELDS



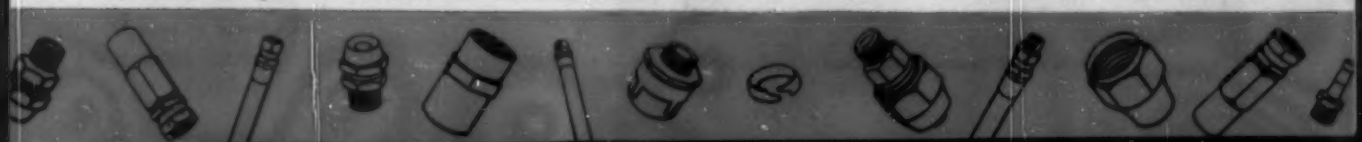
First tractor to use power steering—the Case "500" Diesel, at work here, uses Eastman "first in the field" Hydraulic Hose Assemblies for 1800 lbs. p.s.i. working pressure. Despite front end weight of 2470 lbs., hydraulic power makes steering almost effortless. Turning over 30 furrows in one "swath," this Case Disc Plow makes fields "move over" 18 feet at a time! Again, J. I. Case, *pioneers in farm machinery* since 1847, chose Eastman, *pioneers in Hydraulic Hose Assemblies.*

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH-10, Manitowoc, Wis.

NOTE:
If you wish to be first in your field—come to Eastman—"first in the field" of Hydraulic Hose Assemblies.

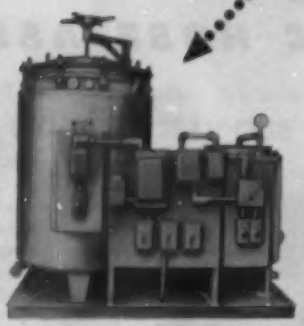
WRITE for Catalog 101 on Eastman Hydraulic Hose Assemblies



HERE'S THE
SURE CURE
for MOST HYDRAULIC TROUBLES.....

The HOFFMAN OIL CONDITIONER

You put a definite stop to the cause of most difficulties in hydraulics systems—dirty oils—when you put a HOFFMAN Oil Conditioner to work.



25 TO 600 GPH CAPACITY

HOFFMAN Oil Conditioners *recondition all types* of contaminated industrial oils—removing both the sludge and solid contaminants plus the "lighter" fluids that change the characteristics of your oil. This two-way clean-up results from the Hoffman's combining two processes in one operation. Oil to be treated is first forced through a "tight" filter, specifically selected for the purpose, where all solid matter is removed—and then the oil goes through a "flash" vaporizer which bakes out all the thinner, higher volatility diluting liquids. This double treatment restores the oil to original prime condition.

Built in capacities from 25 to 600 gph—or bigger for special installations, HOFFMAN Oil Conditioners come in stationary or portable models. They can hook into hydraulic systems for reconditioning the oil without interrupting your equipment's operation. They are now turning in fabulous economy records in oil conditioning on hydraulic oils in aviation and other fields, and on insulating, compressor, turbine, diesel lube, vacuum pump, cable and roll, and other industrial oils.

Another basic style in the industry's most complete line of filtration equipment is this HOFFMAN Disc Filter. First designed to meet aviation requirements of small space, light weight, and low initial cost—yet providing high flow, this disc style is now a favorite in industry for easy installation, efficiency, dependability, and low maintenance.

HOFFMAN Cartridge Filters, with many kinds of media, perform specific separations—even the removal of most minute particles. Wide range of designs and capacities permits exact selection for your particular need.

Let Hoffman Filtration specialists co-operate in correcting your maintenance problems in oil and other fluids. Send in the coupon for bulletins on specific types of Hoffman Industrial Filtration Equipment.

INDUSTRIAL FILTRATION DIVISION

U. S. HOFFMAN MACHINERY CORPORATION

Dept. AH, 105 Fourth Ave., New York 3, N.Y.

U. S. HOFFMAN Machinery Corp.
Dept. AH, 105 Fourth Ave., New York 3, N. Y.

Please send me the bulletins checked on Hoffman Filtration Equipment.

Name .....
Address .....
City ..... State .....

___ Disc Filters
___ Cartridge Filters
___ Oil Conditioners
___ Pressure Filters
___ Flotation Clarifiers
___ Magnetic Separators
___ Vacu-Matic Filters

USEFUL LITERATURE

bushings. Information throughout the bulletin is mostly in tabular form, there is data relating to all sizes. Included are cross-section drawings, bushing numbers, bore sizes, dimensions, weights, keyseats and list prices. Bulletin A-628A available from Dodge Manufacturing Corp.

Circle 226 on Reader Service Card

HYDRAULIC RELIEF VALVES . . . By-pass, piston type, oil-relief valves for use with oil hydraulic pumps where specific pressure must be maintained. The Fulflo Specialties Co. Inc., has released a 4 page bulletin in color describing these valves. The models available are equipped with one of five different springs, for pressure selections from 0 to 500 psi. Pipe sizes are ¼ in to 2 in. Cross-section views show construction of the valve.

Circle 227 on Reader Service Card

CYLINDERS . . . for air and hydraulic operation featuring unusually large capacity to size ratio are explained in catalog No. 750 offered by Hanna Engineering Works. The catalog consists of 16 pages and is filled with information about cylinders. A cross section view shows the construction and features. The various mountings are illustrated and the specifications are given for 1-½", 2", 2-½" and 3" bores which are available. Dimensional data given for the mountings will assist in preparing machine layout drawings. Both push and pull forces are given in a capacity chart for each cylinder size at various pressures between 30 psi and 750 psi.

Circle 228 on Reader Service Card

TUBE WORKING TOOLS . . . A new pocket size catalog providing condensed listings of the complete line of tube working tools of The Imperial Brass Mfg. Co. is available. Included in booklet No. 3030 are all of the tools for cutting, flaring, bending, swedging, reaming and pinch-off of tubing. Test plugs and tools for refacing flared fittings are included. Tools for copper, aluminum, steel and stainless steel tubing are also shown. Flaring tools are listed in both 45 and 37 degree types.

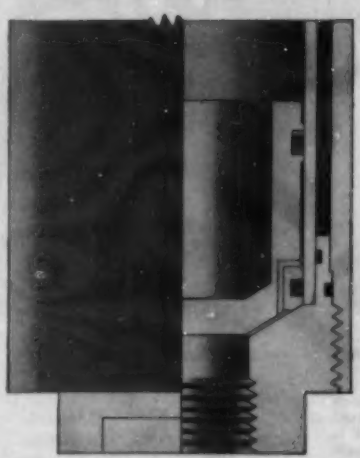
Circle 229 on Reader Service Card

SELF-LOCKING FASTENERS . . . Consisting of screws, bolts, set screws, hex nuts, clinch nuts, cap nuts and threaded inserts are presented in catalog 11A, released by The Nylok Corp. The locking medium is a tough resilient nylon pellet inserted permanently in the body, of the bolt, screw, nut or special fastener. This locking medium projects slightly beyond the crest of the thread and when the mating parts are engaged the highly resilient nylon is compressed but not cut. The fasteners will lock in any position, along the

Continued on page 178

Superior ACCUMULATORS

Single or Double Shell . . . also Intensifiers



This shows construction of Superior Double Shell Accumulator

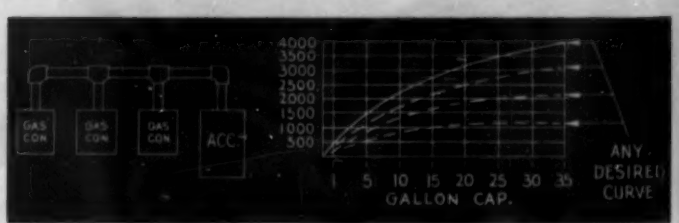
ACCUMULATORS ARE AVAILABLE FROM 5 CU. in. TO 8640 CU. in.

The SUPERIOR Accumulator makes available to industry a floating piston type cylindrical unit designed to provide maximum service life. The double shell construction employed in this design provides a pressure balanced inner shell containing a piston as a separator between the precharge gas and the working medium. The outer shell acting as a gas container and a protective cover insures that damage inflicted to the outer shell through rough handling will not interfere with the free movement of the piston. Rapid decompression of the precharge gas, resulting from rapid discharge of the working medium, provides a coolant around the entire working area of the inner shell, thus, the accumulator temperature is at the lowest possible level.

The piston, constructed with two standard 'O' rings has pressure balancing ports to provide equal pressure to either side of each ring, reducing the tendency to extrude and further eliminating the possibility of pressure lock between 'O' rings. A dash pot is provided to decellerate the piston travel effecting a gradual cessation of movement preventing the tendency to hammer at the end of the stroke, thus, the entire swept volume of the unit can be available for work. Spiral Teflon non-extrusion back-up rings is an added design feature that reduces friction and wear, resulting in maximum service life at minimum maintenance cost.

Superior Accumulators are of flexible design and can be developed to meet your specific hydraulic operating conditions.

Consult us on your Accumulator and Intensifier needs



Manifolding auxiliary gas containers to the accumulator enables the design engineer to accomplish any desired predetermined pressure curve.

Superior

CLEVELAND OFFICE
15201 ST. CLAIR AVE.
CLEVELAND 10, OHIO
• POTOMAC 1-9313 •

HYDRAULICS DIVISION
SUPERIOR PIPE SPECIALTIES COMPANY
2917 S. Cicero Ave., Phone OLympic 2-9132 Cicero 50, Ill.

FOR DISTRIBUTION OR REPRESENTATIVES IN YOUR AREA CONTACT THE CLEVELAND OFFICE

USEFUL LITERATURE

threads. When a fastener is removed, the locking element seeks to return to its original shape. They will also seal against liquid leakage. Specifications including thread sizes and dimensions are charted.

Circle 230 on Reader Service Card

HYDRAULIC PRESSURE REDUCING VALVES . . . designed for aircraft and industrial uses, are described in a bulletin offered by GAR Precision Parts, Inc., Available in ¼ and ⅜ in od ports, they can be obtained from stock in either 1500 or 3000 psi. These lightweight valves are free of "chatter" and "whistle" at reduced pressures.

Circle 231 on Reader Service Card

FLUID CONTROLS . . . Catalog 2A, containing 62 pages, has recently been released by Hoke, Inc., covering the products which they manufacture. The controls presented are, needle valves, toggle valves, packless valves, needle valve controls, pressure regulators, accessories and fittings, stainless steel cylinders, flogages and oxy-gas torches. Each of these products is handled in the catalog as a separate section. Very complete information is contained in the catalog, answering questions on thread sizes, connection sizes, styles, materials, specifications and applications.

Circle 232 on Reader Service Card

3000 PSI HYDRAULIC PUMP . . . A 12 page catalog released by Dowty Equipment Ltd. answers questions on the construction, pumping operation and working principles. Weighing only 10 lbs, the pump delivers oil at pressures up to 3000 psi and ceases delivery automatically when a service is completed. This eliminates the use of automatic cut-out valves, pressure relief valves etc. The internal construction and mechanism of the pump is illustrated. There are functional diagrams, theoretical diagram showing working principles and performance charts of two pump types. Included also are standard dimensional drawings.

Circle 233 on Reader Service Card

HAND TACHOMETERS . . . which measure the speeds of rotating parts and moving surfaces are described in bulletin No. 103, offered by Metron Instrument Co. There are three separate ranges in the one instrument. Only one range appears at a time. Ranges are selected by flipping a switch. The unit employs a simple electric circuit, consisting of a battery, a current indicator, a capacitor and a speed driven switch that alternately reverses the polarity of the capacitor.

Circle 234 on Reader Service Card

PISTON ROD BOOTS . . . can be fabricated from two or more weights of materials to meet specified operating conditions in the protecting of air and hydraulic cylinders. Can be made round, square, or rec-

Continued on page 180

PRECISION BUILT for LONG LIFE
and PEAK PERFORMANCE
HI-LO-PAC PUMP
STROKONTROL RAM
HORSEPOWER PUMP
HORSEPOWER RAM
HORSEPOWER VALVE
HYDRA-SEAL COUPLER
Char-Lynn
HYDRAULIC
RAMS
STROKONTROL RAM
MODEL 1032—3½ inch bore. Available in standard 8 inch, 13 inch and 16 inch stroke lengths. Double acting. Incorporates easily adjusted hydraulic depth stop.
HORSE POWER RAM
MODEL 1002—3 inch bore. Available in standard 8 inch, 10 inch and 12 inch stroke lengths. Designed as double acting and is easily converted to single action by venting one port.
Modifications of these cylinders can be made to fill your specific requirements. Designed to ASAE-SAE specifications.
Write for FREE Catalog!
CHAR-LYNN COMPANY
Dept. AH-10, 2843-24th Avenue South, Minneapolis 6, Minnesota
Hydraulic Horsepower To Serve You Better
Char-Lynn

The Timken Company Protects $500,000 Furnace With—

FIRE-RESISTANT PYDRAUL

First tunnel-type furnace for billet heating uses 1,000 gallons of Monsanto fire-safe hydraulic fluid

50 tons of steel per hour is the capacity of this furnace. Safe Pydraul actuates 3 hydraulic operations: billet-charging machine, car separators and car lifts. Non-corrosive Pydraul can be re-used again and again, cuts oil make-up 60%.

Pydraul Reg. U. S. Pat. Off.

Near heat or flame, ordinary hydraulic fluid is a serious hazard. Spraying from a line break, it can ignite to cause injuries, loss of production, costly equipment shutdowns.

That's why The Timken Company insisted on Pydraul in this new heat-treating furnace at Canton, Ohio, built by Swindell-Dressler.

Pydraul will not sustain flame. In tests, when sprayed into a 6000°F. oxyacetylene flame, it does not support combustion. At Timken the furnace temperature may go to 2300°F. Heat that would set ordinary fluid aflame does not ignite Pydraul.

Since industrial fires give no warning before they start, check the hydraulic fluid now used in your plant. Is it fire-resistant? If not, let us tell you about Pydraul . . . a recent price reduction makes it more than ever the most economical fire-resistant fluid in actual use. For information, call any Monsanto office.

This report, "Pydraul F-9," will be sent on request. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, Box 478, St. Louis, Missouri.

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tangular. All combinations are designed to operate in angular, horizontal or vertical positions. Heavy, medium and light materials may go into a single unit. Useful for sheaves, boots, way-protectors and machinery covers. Bulletin SPC-1, released by A & A Mfg. Co. explains that the parts are fabricated from a neoprene-base material, which is impervious to oil, grease and water and withstands temperature extremes —60 F to 220 F without cracking.

Circle 235 on Reader Service Card

SELECTOR VALVES . . . for 2-way, 3-way and 4-way usage are described in bulletin No. 754, available from Republic Manufacturing Co. Supplied in six sizes from ⅛ in to 1 in pipe or tube, these valves require no lubricant and are suitable for temperatures from —65 F to 250 F. Working pressure of 100 psi is recommended for air, oil or water. The body is available in either aluminum or stainless steel. An illustration and adequate description is included for each type.

Circle 236 on Reader Service Card

SILICONE RUBBER POLYMERS . . . identified as 400 Gum, released by Dow Corning Corp., can be compounded with a wide range of vulcanizing agents to produce silicone rubbers suitable for a variety of applications. Clear, uniform and nontoxic, 400 Gum is a dimethyl silicone gum of high molecular weight and extremely high viscosity. Williams plasticity is 45 mils, specific gravity at 25 C is .98. "Compounding silicone rubber with Dow Corning Gum" is the subject of preliminary data sheets released by the company.

Circle 237 on Reader Service Card

HYDRAULIC OILS . . . their selection and use is discussed in a new three color catalog designed to aid consumers in making the proper choice of oils. Issued by The Denison Engineering Co., Bulletin No. 45 contains 15 pages and presents all the facts about hydraulic oils and the importance of carefully selecting the one suitable for each operation. Some of the sections of the bulletin reveal "Factors Affecting Hydraulic Oil Performance" and "Procedure to Assure Suitable Oil Condition." The catalog is well illustrated with photographs and charts.

Circle 238 on Reader Service Card

FLOW REGULATORS . . . The combination by-pass and restrictor type flow regulator is used to maintain a constant flow when pump output varies or is greater than required for part or all of the system. They can be used in series to divide the pump output into two or more regulated flows and by-pass the excess. Oil

Continued on page 182

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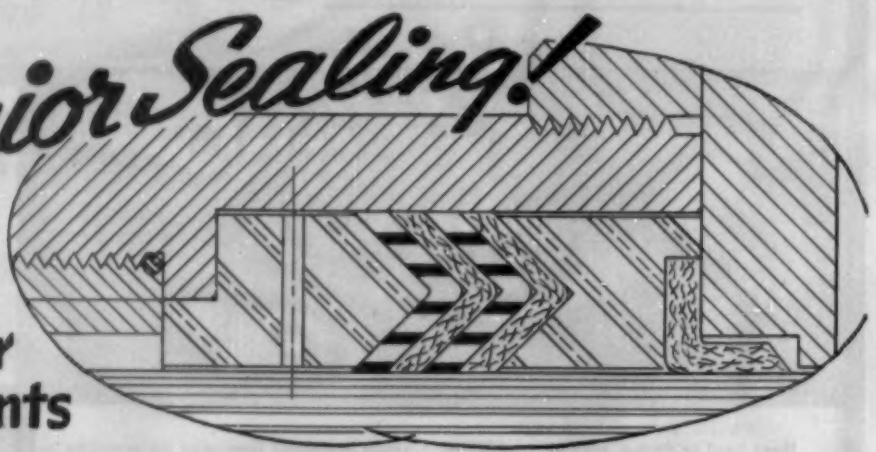

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- Has positive stroke in both directions.
- Does not depend on spring return or outside power sources.
- Is a self-contained hydraulic system for positive positioning of remotely-located levers, shafts, and other equipment.
- Valuable in controlling hydraulic valves, winches, marine engines, charging cranes, slitting machines, butterfly valves etc.

Write for bulletin describing the control with graphs and showing its many uses.

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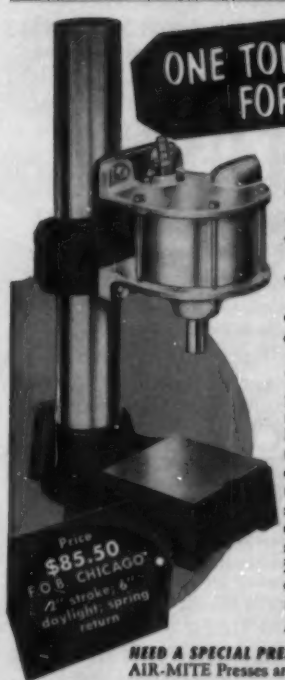

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You get more for your money when you choose AIR-MITE—more press, more utility and more production. Built by air press specialists to meet the demand for a low cost unit that could stand the gaff of high production work, AIR-MITE presses will show you quality, efficiency and economy you never thought possible at their price. Made in ¼, ½, ¾ and 1 ton capacities with spring or air return.

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Circle 123 on Reader Service Card

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VALVES *for Air & Fluid Power*

Solenoid, Motor, Lever, Foot types for every medium

Style E 4-Way

Nicholson furnishes valves for cylinder control, distributing, metering and for many special operating cycles. Installations in a wide range of plants have been in constant service for well over 25 years. In addition to their long wear and minimum maintenance, Nicholson valves feature: specially treated hard seats and lapping flat discs which actually become tighter with use; choice of 6 metal combinations to suit your specific service; positive protection against grit. Sizes, ¼" to 2½". Pressures up to 5000 lbs.

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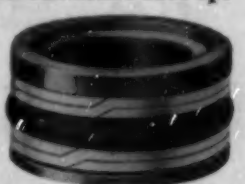

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USEFUL LITERATURE

passing through the orifice in the sliding valve creates a pressure differential that pushes the valve back against the spring. Since the spring exerts essentially a constant force, the pressure differential is constant and the flow to create the differential is constant. Available in sizes ¼, ⅜ and ½ in pipe. Sheets No. 3.40, 3.41a and 3.42, released by Fluid Controls, Inc., give complete dimensional and application data.

Circle 239 on Reader Service Card

PNEUMATIC VALVES AND CYLINDERS . . . A system of control based on a wide series of combinations of a number of standard items form a complete range of air cylinders and control valves. A 52 page catalog in color released by Lang Pneumatic Ltd., describes the units. Valve section includes slide, hand control, mechanically operated, automatic control, pilot, impulse, unloader, solenoid, solenoid operated pilot and double solenoid. Cylinders are shown from 1" to 12" bore. Many other sections add to make a thoroughly complete presentation. All necessary sizes and features are shown for each unit. There are many illustrations, some in section and others in outline.

Circle 240 on Reader Service Card

HIGH PRESSURE FILTERS . . . The Trabon Engineering Corp. has published a 2 page bulletin No. 545, on their high pressure lubrication filters. They are constructed of high tensile cast aluminum with steel sump and tie rod and are built to withstand 1000 psi working pressure and 1800 psi test pressure. The bulletin includes dimensional material, illustrations, diagrams and comprehensive flow loss charts.

Circle 241 on Reader Service Card

FLOWMETER . . . A bulletin, one of a series prepared for the benefit of flow meter users in the automotive, aircraft, chemical and petroleum industries, is No. 1053 prepared by Commercial Research Laboratories, Inc. The bulletin includes major design and construction features of the type 12-100 series unit, maximum flow ranges, and various combinations of metering tubes and by-pass valves which can be used in series. Complete mounting drawings are available. The use of logarithmic rather than the usual linear type scale markings greatly increase the accuracy and readability.

Circle 242 on Reader Service Card

GASKET SEALABILITY . . . A recent bulletin, "How Flange Surface Finishes Affect Gasket Sealability and Joint Performance", is available from Johns-Manville. It is the latest in a series of illustrated technical bulletins. The title of the series is "The Gasket". In the current bulletin, the effect of flange surface finishes upon the performance of a gasket, is discussed. The bulletin should be of definite help, for those who buy,

Continued on page 184

Circle 81 on Reader Service Card

And Now-A Gresen

MULTI-CONTROL VALVE

Capacity 24 GPM
Max. Pressure 1250 PSI
Parallel Application

Model V P

Another Gresen Engineering Triumph In Quality Hydraulics

For Mobile and General Industrial Applications.

FEATURES - - -

- **Fully Balanced—Self Centering—Built-in Adjustable Relief Valve.**
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Center sections are available making additional Controls in this Multi-unit.

Write for full details about this better built, money saving valve.

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COMPONENTS for VAPORS and LIQUIDS

- **HIGH & LOW PRESSURE ROTARY JOINTS**
  balanced piston uses line pressure to control friction
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  design eliminates pressure surges and pulsations at the gage
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  amazingly low swivelling torque reduces power loss and wear
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  positive sealing—full flow
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  relieves, equalizes pressures to predetermined setting

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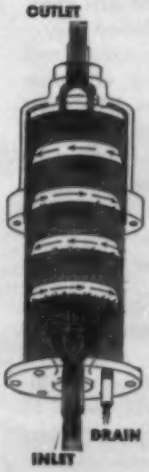
SCRUBS, CLEANS AND DRIES
On Air and Gas Lines



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The Aridifier's patented centrifugal-baffle action traps 92% of all dirt, oil, scale and water in gas or compressed air . . . and drains off these troublemakers *before* they can damage tools and equipment.

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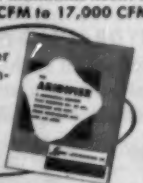

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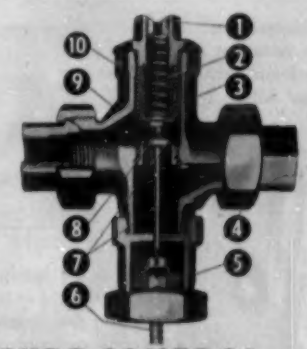

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Not just another temperature control valve, but a skillfully engineered instrument designed and constructed to outperform and outlast any ordinary unit. Check these features:

1. **Fully adjustable within range of control.**
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3. **Monel seal bellows — no packing.**
4. **Double union — easy installation... IN ANY POSITION**
5. **Monel thermostat bellows assures trouble free operation.**
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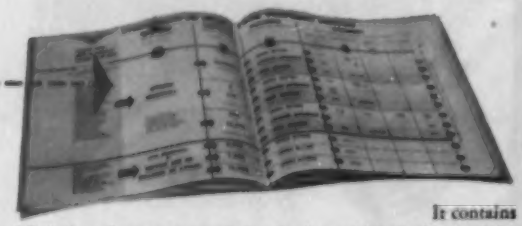
Circle 155 on Reader Service Card

FREE to Design, Plant, and Safety Engineers

A NEW, COMPLETE REFERENCE FILE OF BARKSDALE HYDRAULIC and PNEUMATIC CONTROLS

It includes important general information such as a detailed description and illustration of the Shear-Seal principle, the only new valving principle in centuries; covers manual and solenoid valves.

It contains a simplified chart for pressure switch selection, which sheds new light on a subject shrouded in mystery.

It presents the only line of solenoid-pilot valves for air and low pressure liquid with a guarantee for longer solenoid and valve life.

Down to the handy pop-up tab, nothing has been overlooked in providing a more useful reference to the design engineer concerned with hydraulic components.

Use the coupon below to get your *free* copy of this valuable information, indispensible to modern hydraulic control.

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Please send a copy of the above described *Free* catalog 4G.

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USEFUL LITERATURE

specify or design joints in which gaskets are used. It provides a basis for selecting the flange surface finish most suitable for a given gasket. It explains why the right finish makes it easy to achieve an initial seal and obtain the best joint performance.

Circle 243 on Reader Service Card

TEMPERATURE TEST CHAMBER . . . is designed for the convenience of research workers and the small laboratory unit. Freedom from delays attendant upon scheduling time in larger chambers permits extensive performance of ambient temperature variation tests, reserving the larger equipment for more elaborate environmental testing. Portable and self-contained, it is suited to production line tests of small products. A folder, offered by Statham Development Corp. explains operating instructions and procedure in addition to specifications. Has temperature range from —65F to 350F.

Circle 244 on Reader Service Card

STAINLESS STEEL VALVES . . . pilot operated for air or hydraulic service is described in bulletin 105, offered by Atkomatic Valve Company, Inc. The new valve, for extremely high pressures, is available in ½, ¾ and 1½ in pipe sizes, ½ and ¾ in are rated to 2500 psi and the 1½ in to 3000 psi. Piston rings compensate for expansion under heat and eliminate sticking. Valves are available for normally open and normally closed operation with bubble tight pilot valve feature. Explosion proof housings are optional for use in hazardous atmospheres.

Circle 245 on Reader Service Card

HOIST CLASSIFICATION CHART . . . The Hydraulic Hoist and Steel Dump Body Manufacturers Association has announced the publication of a hoist classification chart. It is claimed to be the first chart of its type in the industry. It has been published to provide a means of standardizing the capacity ratings and as a convenient method for comparison of hoists manufactured by the association members. The chart places all hoists in classes depending on the torque rating in inch-pounds developed by the hoist around its hinge shaft. Also included is a table determining the size or rating of hoist needed for any use. Included also is a glossary of terms used by the industry.

Circle 246 on Reader Service Card

HYDRAULIC POWER UNITS . . . groups hydraulic equipment such as reservoir, motor, pump and control valves, into a single unit to simplify and improve the overall design of a machine. Catalog C-102, issued by Hydraulic Power Equipment Co. describes standard power units, which includes a small series, medium series and heavy duty units. Custom designed units are also included. Outline drawings and tables show tank

Continued on page 186

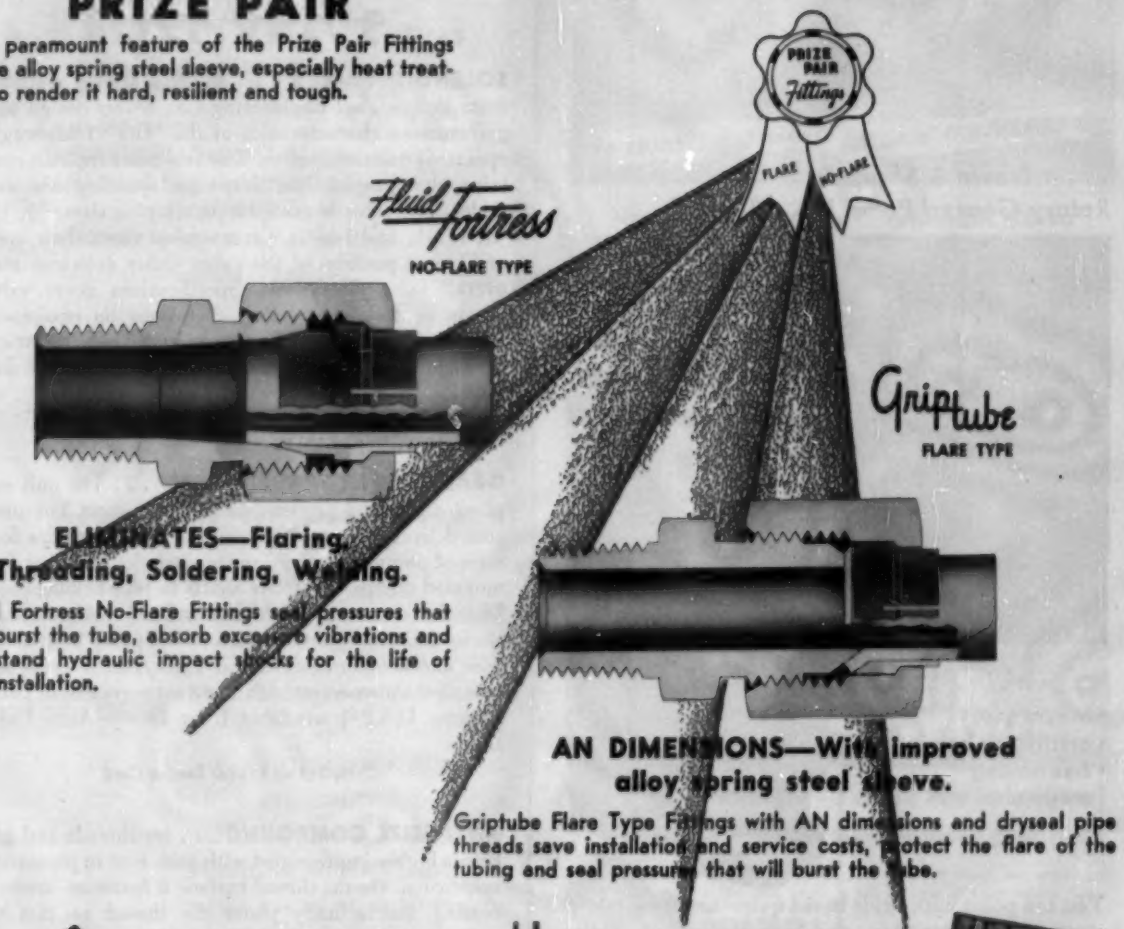
FLODAR

STANDARD (J.I.C.)

TUBE FITTINGS

PRIZE PAIR

The paramount feature of the Prize Pair Fittings is the alloy spring steel sleeve, especially heat treated to render it hard, resilient and tough.



ELIMINATES—Flaring, Threading, Soldering, Welding.

Fluid Fortress No-Flare Fittings seal pressures that will burst the tube, absorb excess vibrations and withstand hydraulic impact shocks for the life of the installation.

AN DIMENSIONS—With improved alloy spring steel sleeve.

Griptube Flare Type Fittings with AN dimensions and dryseal pipe threads save installation and service costs, protect the flare of the tubing and seal pressures that will burst the tube.

HIGH PRESSURE STEEL PIPE FITTINGS

With Flodar Pipe Fittings the installation man can make a variety of connections involving a large reduction between pipe size and tube outside diameter.

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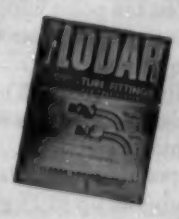

Ask for catalog No. 553 describing complete line of tube fittings, pipe fittings and accessories. Catalog includes important engineering data, installation instructions and tubing recommendations.

FLODAR FITTINGS exceed the performance requirements of MIL-F-5506. J.I.C., section H4.1.6

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. . . a Brown & Sharpe Rotary Geared Pump No. 53 or 55

with

- helical gears
- antifriction bearings
- free turning mechanical seal

You can point with pride to the quiet-operating pump that gives smooth flow and long service when you equip your machines with Brown & Sharpe Rotary Geared Pumps. They deliver large volumes of oil at high speeds and under pressures up to 200 psi with a smoothness and quiet made possible by helical gears operating on antifriction bearings. The No. 53 pump supplies up to 23 gpm; the No. 55 up to 34 gpm.

Write for the illustrated Brown & Sharpe Catalog describing 185 stock pumps. Brown & Sharpe Mfg. Co., Providence 1, R. I.

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dimensions, capacity in gallons, gpm, and motor hp. Power units can be applied to many purposes and types of equipment. Auxiliary equipment such as heat exchangers, accumulators, pressure switches, solenoid controlled relief valves may be applied and can be mounted and piped either on a panel or on the reservoir.

Circle 247 on Reader Service Card

SOLENOID VALVES . . . Bulletin M-500 available from Eclipse Fuel Engineering Co., covers design and performance characteristics of the "DO" (diaphragm operated) solenoid valves. The two color bulletin contains photographs, line drawings, specifications and tables. The valve is available in six pipe sizes, ⅜, ½, ¾, 1, 1-¼ and 1-½ in. Cross-section views show open and closed position of the valve. Other drawings give overall valve dimensions. Specifications cover valve use in control and cycling operations on equipment using air, water, oil, refrigerants and gases. Electrical characteristics and materials of construction are also given.

Circle 248 on Reader Service Card

GEAR TYPE HYDRAULIC PUMP . . . The unit employs a patented pressure balancing system. For pressure deliveries up to 2000 psi, the range includes four sizes of pumps. Standard range, includes flange or foot mounted pumps with drive shafts to take flexible couplings for direct drive or pulleys for V-belts. A chart shows delivery (gpm) of each model pump both clockwise and counter-clockwise at 1500 rpm. A cross section view shows construction and arrangement of parts. Bulletin D.A.2/1 available from Dowty Auto Units, Ltd.

Circle 249 on Reader Service Card

ANTI-SEIZE COMPOUND . . . for threads and gaskets is highly impregnated with pure lead in permanent suspension. On the thread surface it forms an armored coating that actually plates the thread so that the galling can never occur. The tightest connection can be made, yet it can be broken at any later date without thread damage. Literature is available from Armite Laboratories. The compound prevents high temperature freeze, pressure leakage, galling seizure and corrosion. Effective to working pressures over 6000 psi, it has a temperature range of—100F to 2987F and will not loosen under vibration.

Circle 250 on Reader Service Card

RUBBER PRODUCTS . . . A 24 page catalog, released by Stillman Rubber Company, illustrates and catalogs the company's many "O" ring designs. Rubber to metal bonding provides parts that are precise, flash-free and of optical smoothness for effective sealing at almost zero pressure. Line drawings are included

Continued on page 188

Circle 101 on Reader Service Card

After two years of research

A RELIEF VALVE THAT DOESN'T LEAK!

- In-line design
- Adjustability that can't be tampered with
- Excellent flow characteristics
- Precise operating reliability
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VHS PUMP MOTOR 3-200 HP

Dimension Data, NEMA Frame 203-587

New technical data sheets provide diagrams and dimensions for *ACEC Vertical Hollow Shaft Pump Motors*, which are designed for deep well irrigation and industrial pumping application. The motor has an extra large canopy protecting ventilation opening. Unusually large oil reservoirs supply precooled oil for lubrication. Centrifugal fan ventilates the entire motor. Glyptal coated FORMACEC windings withstand both moist and arid atmospheres. Heavy duty thrust bearing completely protected from extraneous matter. Motors equipped with pin type standard reverse protection clutch or optional fitting of ball type non-reverse ratchet. Data sheets and distributor list available from ACEC ELECTRIC CORPORATION, Dept. I, 40 East 49 Street, New York 17, N.Y.

Circle 28 on Reader Service Card

Circle 80 on Reader Service Card

NOW! Fast Fingertip Bleeding!

Patent Pending

New Greer-Lane Semi-Automatic Valve Ends Bleeding Problems Forever!

This new, revolutionary valve cuts hydraulic bleeding time to minutes, and saves costly hydraulic fluid. Effectively dumps air pressure of pneumatic systems too. A twist of your fingers... release... the job is done! It's fast, clean, safe and *self-cleaning*. No sediment can clog its tiny port openings or mar its operation. Precision-made to give years of dependable, trouble-free service. Easily installed. Each valve pays for itself quickly. Don't let poor bleeding methods bleed your pocketbook. Call or write Greer today

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Model 1AM Up to ¼ HP — only 2½" dia., weighs 1½ lbs.
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PRODUCT DESIGN FILE

solve tough original equipment problems

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Now standard equipment on many products. Four sizes, many design variations. Vertical or horizontal drives; base or flange mountings.

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Original Equipment Manufacturers for Over 25 Years

GAST ROTARY AIR MOTORS • COMPRESSORS • VACUUM PUMPS
(TO 4 H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., Makley St., Benton Harbor, Mich.

Circle 74 on Reader Service Card

USEFUL LITERATURE

for the "O" rings showing dimensions and data for installation. Complete size information is given for each "O" ring. Included also is a section on miniature "O" rings, a service recommendation chart for "O" rings and test reports.

Circle 251 on Reader Service Card

FIBERGLASS-SILICONE TUBING . . . for compressed air circuits is laminated and made from single sheets of fiberglass cloth and bonded by a special pressure cure for extreme flexibility. Can be used for connecting vibrating parts without cracking, corroding or delaminating. Suitable for connecting misaligned parts and for dampening uncontrolled vibration. Standard couplings can be used and they are immune to extreme variations of heat or cold and moisture. Available also for ducts, lines, couplings and sleeves. Orchard Industries, Inc., has prepared descriptive literature.

Circle 252 on Reader Service Card

SOLENOID VALVES . . . New bulletin A-3 describes and illustrates additions to the line of general service solenoid valves manufactured by J. D. Gould Co. Included in the models are normally closed or normally open types in three sizes, 1" 1-¼" and 1-½". Designed to eliminate hammer and shock in automatic or remote control of liquid flow, air or gas. Features include cast bronze construction, piston-pilot operation, full ports and water and oil proof coils. Will handle pressures from 1 to 300 psi.

Circle 253 on Reader Service Card

SEALER FOR LOCKING ADJUSTABLE VALVES . . . Typical applications, properties, chemical resistance and applications of the tamper proof sealer are described in a data sheet available from Minnesota Mining and Manufacturing Co. It is told how critical or delicate parts or instruments can be safe-guarded from unauthorized handling. A break in the seal is readily detected and cannot be repaired. It is white, fast drying, soft paste that can be applied over adjustable parts. Will adhere well to aluminum and steel.

Circle 254 on Reader Service Card

SAFETY AND RELIEF VALVES . . . Safety valves are for use with gases which include compressed air. Their design includes a chamber which utilizes the expansion forces of air to effect quick opening (popping) and closing actions. Relief valves are normally used for liquid service. The relief valves slowly open as pressure increases and slowly close as the pressure decreases. Kunkle Valve Company completely describes

Continued on page 190

Air and Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 60" DIAMETER • STROKES OF 50 FT. AND LONGER

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

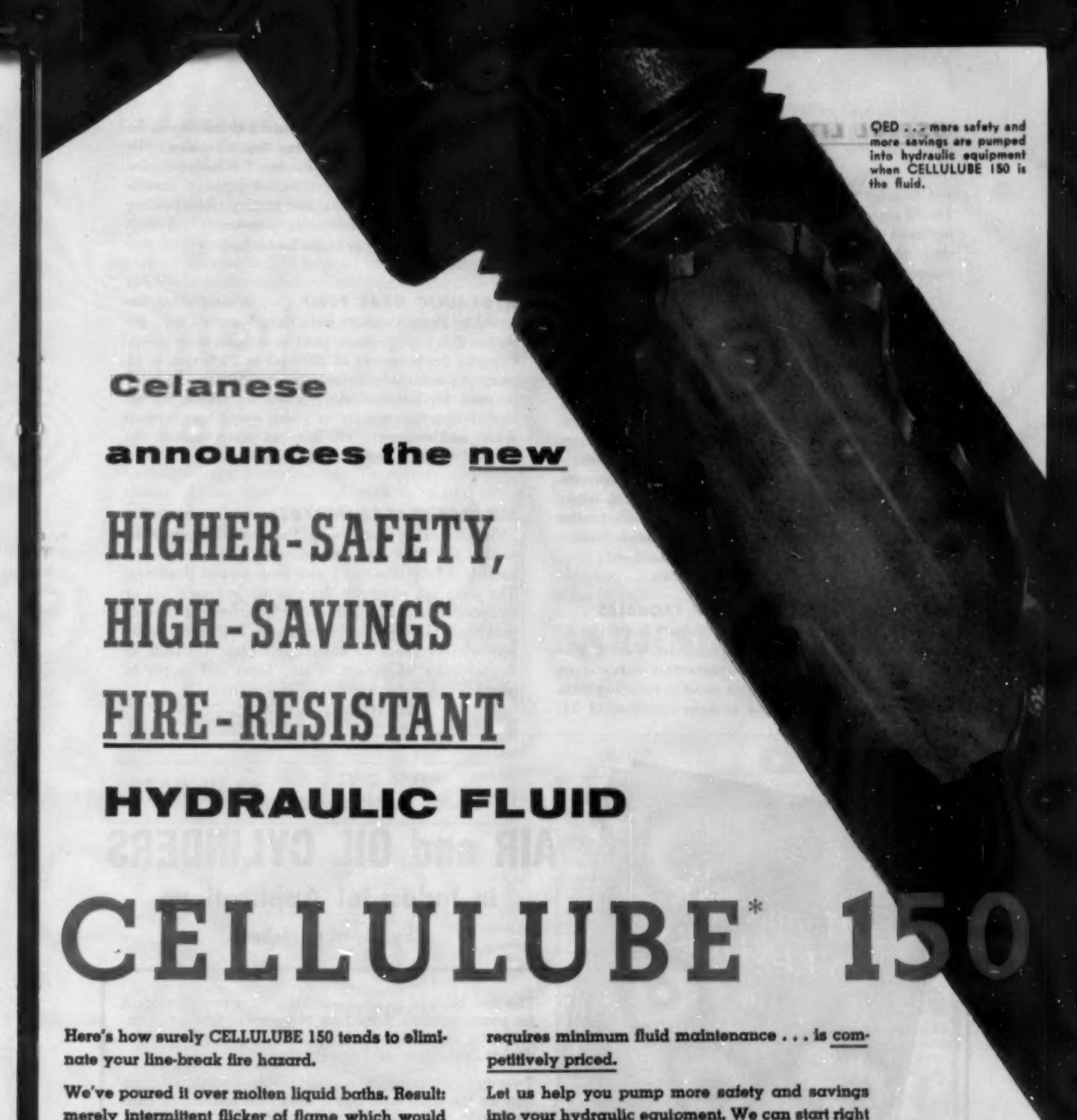
Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

18½" Bore
13" Rod
3000 PSI

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN
MACHINE CO., INC.
326 West 2nd Street—Salem, Ohio

Circle 108 on Reader Service Card Circle 41 on Reader Service Card



QED . . . more safety and more savings are pumped into hydraulic equipment when CELLULUBE 150 is the fluid.

Celanese

announces the new

HIGHER-SAFETY, HIGH-SAVINGS FIRE-RESISTANT HYDRAULIC FLUID

CELLULUBE* 150

Here's how surely CELLULUBE 150 tends to eliminate your line-break fire hazard.

We've poured it over molten liquid baths. Result: merely intermittent flicker of flame which would not support combustion.

We've atomized CELLULUBE 150 onto hot metal flame-heated to approximately twice the temperature at which petroleum based fluids spontaneously ignite. There was no ignition with CELLULUBE 150.

In addition to providing such outstanding fire resistance, CELLULUBE 150 assures excellent lubrication . . . is non-corrosive, non-reactive, chemically stable, long-lasting . . . contains no additives . . . has a high boiling point (approx. 790° F.) . . . requires minimum fluid maintenance . . . is competitively priced.

Let us help you pump more safety and savings into your hydraulic equipment. We can start right away by sending you technical data . . . and supplying answers to your specific hydraulic fluid problems. Your request will get prompt attention.

Celanese Corporation of America,
Chemical Division, Dept. 588-J
180 Madison Avenue, New York 16, N. Y.

Celanese* CHEMICALS

*Reg. U.S. Pat. Off.

USEFUL LITERATURE

and catalogs the various units available in catalog 53. The 52 page booklet is fully illustrated. All information pertinent to the product is included. Cross section views show construction of the valves and arrangement of component parts.

Circle 255 on Reader Service Card

SHOCK AND VIBRATION CONTROL . . . The first periodical devoted exclusively to shock, vibration and noise isolation, is now being published by the Barry Corp. Called "Shock and Vibration Control Notes", the new house organ is intended to provide a medium for the collection and propagation of ideas and information on this subject. Each issue will contain editorials dealing with specific technical problems. Many reports will be based on the company's research. Issues will include articles based on problems sent to the company engineering department for solution.

Circle 256 on Reader Service Card

LOCATING AIR COMPRESSOR TROUBLES . . . in vertical, water cooled air compressors is subject of new bulletin L-676-M1, being offered by Worthington Corp. This is one of a series on preventive maintenance being issued by the company to assist in reducing costs of operation. It is designed to help operators of YC and DYC compressors detect existing troubles and be alert to ways these can be prevented. Graphically illustrated, it clearly explains reasons for such troubles as failure to deliver air, insufficient capacity, insufficient pressure, vibration, overheating, overloading motor, low or high intercooler pressure.

Circle 257 on Reader Service Card

HYDRAULIC GEAR PUMP . . . A data sheet, released by Pesco Products Div., Borg-Warner Corp., describes this high pressure positive displacement pump. Capacity for pressures of 2000 psi at 2400 rpm is 11 gpm. An outline drawing showing dimensions may be used for installations. Engineering charts are included showing capacity vs pump speed, hp vs pump speed, and volumetric efficiency vs pump speed.

Circle 258 on Reader Service Card

SURFACE HEAT TRANSFER . . . A new catalog No. 5554 offered by the Young Radiator Company, describes the plate type fin and round tube core. The catalog is fully illustrated with cross section drawings. The units are adaptable for cooling hydraulic oil or compressed air. Straight in-line arrangement permits maximum airflow. Can be used with any tubing material without braze or solder problems. Available in copper brass, aluminum or steel tubes and copper or aluminum fins for every type of service.

Circle 259 on Reader Service Card

AIR and OIL CYLINDERS

in Industrial Applications

by Elmer F. Heiser

The first book of its kind—written by a practical man for practical men. Based on 18 years of first hand experience in working with plant people on cylinder design, selection and application.

Twenty-one chapters packed with useful information for the man who buys, uses and maintains both hydraulic and pneumatic cylinders.

One chapter—"Cushion Limitations and Variations"—is the most complete practical treatment on cushions ever published. Other chapters are devoted to Ordering Information, Standard and Not-So-Standard Cylinders, Operating Speed, Shock, Mounting Clearances, Air Power-Oil Control.

Publication date October 1
$5.00 per copy, postpaid

On Display at NCIH
Hotel Sheraton Chicago
October 14, 15

SERVICE DEPARTMENT

APPLIED HYDRAULICS

1240 Ontario St. • Cleveland 13, Ohio

SMALL AIR VALVE . . . Just published by Ross Operating Valve Company, bulletin 307 describes and illustrates a 4-way valve, 2" high, with poppet type seals. Bottom ported base plate permits removal of body without disturbing piping. The bulletin contains operation and recommended service information, installation data, parts list and exploding view of component parts. Pressures to 125 psig air and temperatures to 175 F are recommended for service. Available in ¼" and ⅜" pipe size.

Circle 260 on Reader Service Card

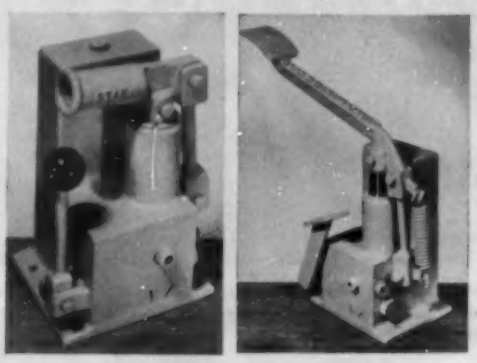
REMOTE CONTROLS . . . Trimount Instrument Company, who recently took over Crown Control Company, issued a bulletin complete with graphs and specifications showing how they improved the MAT type of Hydra-Trol remote controls for controlling hydraulic valves, winches, marine engines, charging cranes, slitting machines and butterfly valves. Also contained is data on the MAR type controls which is a gravity feed unit.

Circle 261 on Reader Service Card

HYDRAULIC CONTROL VALVES . . . Dimensional data and features of directional valves for mobile equipment applications, covering 1, 2, 3, and 4 spool models from 8-35 gpm capacity, are provided in a new 10 page catalog file published by Industrial Hydraulics Division, The Parker Appliance Company.

Circle 262 on Reader Service Card

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



- **HAND AND FOOT OPERATED**
  Two speed construction provides automatic change over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—3 models (½"-⅜") (½"-1¼") (½"-1½")

Representative areas available

Star Jack Co. River Grove, Ill.

Circle 154 on Reader Service Card

Circle 188 on Reader Service Card

EXPLOSION-PROOF
Solenoid Valves

Available in ¼, ⅜, ½ and ¾
Four-way and three-way
150 p.s.i.
Product of Crescent Valve Co.

Extremely short solenoid stroke plus pilot operation eliminates problem of coil burn out.

Poppet design with linear sealing contact on resilient seat makes both pilot and main valve self scavenging. No damage from dirt or pipe scale.

Cover plate is removable, coils are interchangeable – easy to convert to any standard voltage.

Write for bulletins 1140, 1141 and 1045.

BARKSDALE VALVES

5125 Alcoa Avenue Los Angeles 58, Calif.

Circle 127 on Reader Service Card

Circle 133 on Reader Service Card

HYDRAULIC and PNEUMATIC QUICK COUPLERS THAT DO THE JOB!

Model 3000

- Guaranteed not to leak
- Amazing free area
- Easy to couple and uncouple
- High quality—Low Cost
- Sizes: ⅜", ½", ¾"

Pressure Ranges

Model 3000—Zero to 30,000 psi for burst. (for operating pressures up to 15,000 psi)

Model 4000 and 5000—Zero to 10,000 psi for burst. (for operating pressures up to 6,000 psi)

Models 4000 and 5000 easily converted to "Break-away" types by using our Break-away Clamp.

Dust Plugs and Caps available for all Couplers

Model 4000

Model 5000

Please write for complete Literature

Pioneer Hydraulics, Inc.

1312 No. 5th St. Minneapolis 11, Minn.

GRIPPING FORCE 15 TIMES AIR LINE PRESSURE

Speedy Air Vise helps you do dozens of operations faster, better, cheaper—by air pressure! Foot control valve opens and shuts vise instantly, leaving *both* hands free to produce *more!* Jaw opens up to 3 inches, holds castings, parts, jigs, etc. Compact and trouble-free.

Complete with Foot Control, Air Hose and Fittings.....only $36.00

Prompt Delivery from Your Supplier or Write Direct

W. R. BROWN CORPORATION • 2600 N. Normandy Ave. • Chicago 35, Ill.

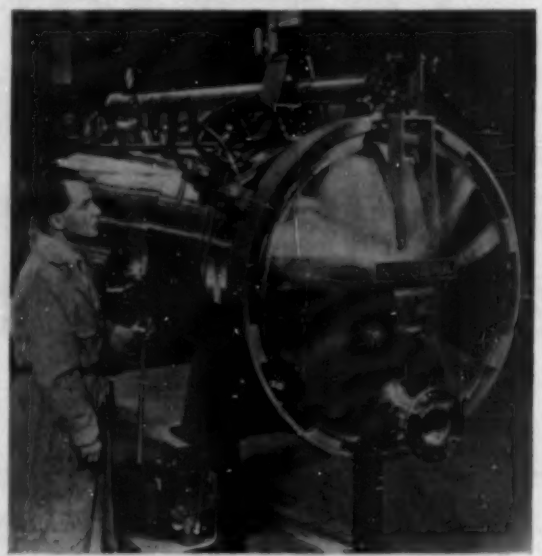
AIR REGULATORS — AIR FILTERS — AIR GUNS — PORTABLE COMPRESSORS

Use of tiedown bolts to hold and seal heavy filter covers is eliminated. New design uses . . .

Hand Pump Circuit For Speed and Safety

To reduce the effort and time it takes to remove the heavy cover on their large filters, the designers at Niagara Filters Division of American Machine and Metals, Inc. have added a hydraulic circuit.

Actuation of the hydraulic pump transmits pressure to two hydraulic cylinders which act to rotate the locking ring. Resultant pressure of the cover against a gasket ring seals the filter securely. Reversing the



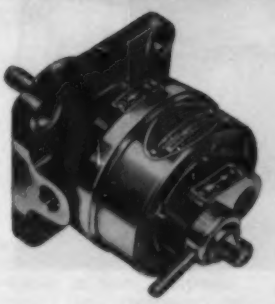
A SMALL FORCE on the handle of the hydraulic pump is all that is needed to remove the heavy cover on this large filter.

motion of the locking ring releases the cover so that it can be removed. This type of closure provides a safety feature in that the cover cannot be opened until the wedges on the locking ring and the cover clear each other. Pressure is automatically released at the first movement of the wedges.

Because of the uniform pressure exerted by the hydraulic system, as compared with the "spot" pressure exerted by hand wheels and eye bolts, even seating of the cover against the gasket is assured. Also, repair and replacement of hand wheels and eye bolts is completely avoided.

Circle 53 on Reader Service Card

SAVERY ANNULAR PISTON PUMP



Fixed or Variable Delivery. Pressures up to 3500 p.s.i.

This compact rotary pump without Gears, Valves, Vanes or Springs is of unique design and extreme simplicity in construction.

- Volumetric efficiency as high as 99%
- Positive action at slowest speeds
- Delivery characteristics unaffected by variation in viscosity, feed or back pressure
- No idle pockets to cause air locks or allow coagulation
- No aeration or agitation of the fluid
- No vibration or hammer
- Leakproof

Write for Full Details

DAVIES BROS. 120 WALL STREET NEW YORK 5 N Y

Circle 99 on Reader Service Card

Protect sensitive pressure instruments . . .

GG gage gard

Shuts off gage or manometer connection at any pre-set pressure.

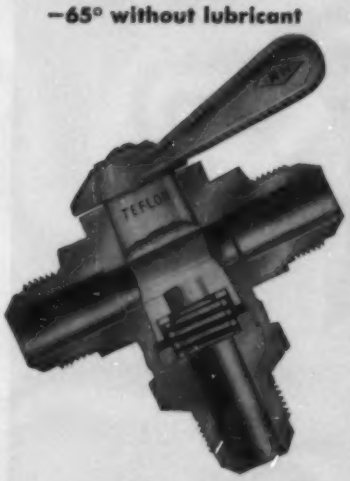
Models available with cutoffs from 1" water to 9000 psig. liquids & gases.

Designed to withstand and hold closed against 10,000 psig.

INDUSTRIAL ENGINEERING CORPORATION
525 E. Woodbine, Louisville, Ky.

NEW! REPUBLIC SELECTOR VALVES NEW!

"LO-TEMP"
–65° without lubricant



LO-TORQ SELECTOR

BALANCED PRESSURE FOR EASY TURNING

With service pressure and seals on both sides of valving disk, turning is easy. Design is simple—maintenance is low. Many services—Air, and gas 4000 psi; fuel, hydraulic oil, petroleum, water, 6000 psi. Made in bronze, semi-steel, aluminum alloy, in three different portings, ⅛" to 1". Request Bulletin No. 454.

LO-TEMP SELECTOR

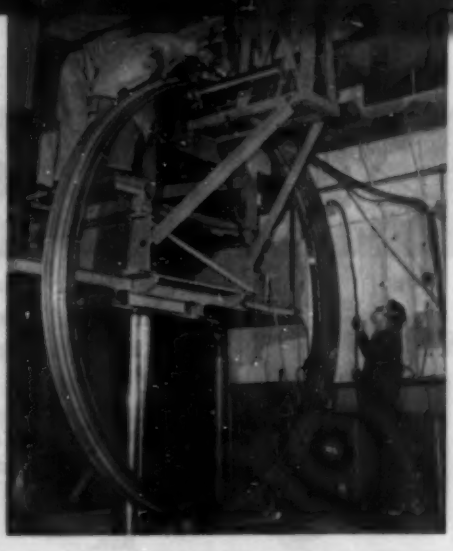
Teflon plug ends the need for lubricant. Easy turning—non seizing. –65° to 250°F. 2- 3- 4-way. 100 psi service. Made in aluminum alloy or stainless steel. ½" to 1" pipe or tube. Request Bulletin No. 754.

"LO-TORQ"
6000 psi service

148

RM

REPUBLIC MANUFACTURING CO.
14656 BROOKPARK ROAD • CLEVELAND 11, OHIO



HEAVY WELDING equipment used in the fabrication of large industrial expansion joints is supported by a standard hydraulic automobile lift. Weld technicians on the platform are working on the outer surface of the expansion joint.

Simple Hydraulic Lift Raises Work Piece for Welding

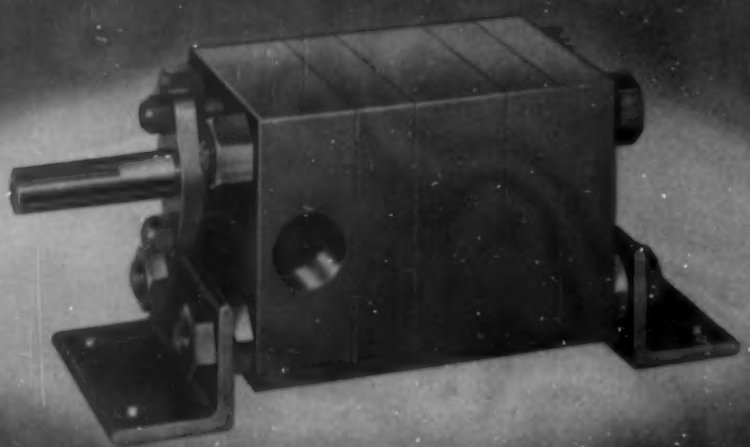
AN ordinary hydraulic automobile lift of the type found in gas stations is giving a boost to production in the bellows division of Solar Aircraft Company in San Diego, Calif. Solar designs and manufactures stainless steel bellows and expansion joints —ranging in diameter from ⅜ in to 28 feet.

To handle the heaviest units during fabrication, Solar production men had to devise special equipment. The hydraulic elevator is used to lift welding equipment or to lift the bellows during the welding process, and is capable of raising a load of three tons or handling a bellows up to 14 feet in diameter.

When the outer surface of the bellows is to be welded, the welding equipment is elevated. For weldin the inside of the unit the procedure is reversed, and the bellows itself is elevated.

Completely standard, the elevator has a ram six feet long with a diameter of 12 inches. It is operated by an independent air compressor system rated at 200 psi, also of the type found in gas stations. When the lift is in an elevated position, supplementary braces are used to hold it in place.

NORTHERN NITRALLOY PUMPS



NORTHERN ORDNANCE INC.
Subsidiary
NORTHERN PUMP CO.
Minneapolis, Minnesota

Circle 120 on Reader Service Card

The Biggest PLUS VALUE in Cylinders

For hydraulic pressures up to 1500 or 3000 p.s.i.

They're sturdy—dependable—economical

Use the hydraulic cylinder that will always give you plus performance in your equipment. Designed and constructed to J.I.C. standards, NEPTUNE-POWER PLUS cylinders are available in seven standard mountings—series 1500 for oil and water pressures to 1500 p.s.i.—series 3-1500 for pressures to 3000 p.s.i.

- Bores from 1 to 24 inches —Strokes to 18 feet.
- Pressure ring design permits head rotation to any pipe location.
- Precision fitted piston rings prevent by-pass while offering minimum friction.
- One piece high pressure, self-adjusting, rod packing provides precision bearing and guide for piston rod.
- Single or double end rods, with cushion.
- Other series available for air pressure.

Write for Catalog AH

NEPTUNE-POWER PLUS PRODUCTS CO.

2228 Bellevue Ave. Detroit 7, Michigan

---

use PERMASEAL **piston rings for hydraulic applications**

Fluid power requirements need the permanently high compression maintained by Permaseal rings. They are precision made for long life hydraulic requirements. 28 years of ring making experience are behind Permaseal rings. Check these characteristics for better made piston rings for hydraulic use:—

- PERMASEAL FEATURE—Permanently leak-proof joint that remains leak-proof even after many thousands of hours of service.
- MATERIAL—Permaseal rings are made from the finest grade of gray iron available; recognized as the best ring material known for long wear and constant wall pressure characteristics.
- UNIFORMITY—Manufacturing methods result in perfect round rings—accurately made to your specifications and carefully tested.
- ASSEMBLY FEATURES—Ring seals equally well in both directions—this eliminates possible errors in assembly—enables use of fewer rings per cylinder.
- LONG LIFE—All Permaseal rings are turned to finish dimensions; micro grooves permit rings to seat quickly. The Permaseal joint compensates for wear to equipment, operating with efficiency far beyond that provided by other competitive rings.
- ECONOMY—The low initial cost and long service life of Permaseal rings give you unusual economy advantages.

Engineering and design service available. Write for price quotations specifying dimensions and tolerances.

Grover piston ring co.

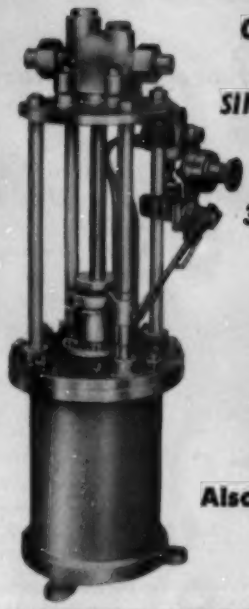
Hydraulic Piston Ring Specialists

120 North Broadway — Milwaukee 2, Wisconsin

Circle 186 on Reader Service Card

AIR-HYDRO-PUMP

60,000 PSI HYDRAULIC PRESSURE (with air—100 psi)



COMPLETE RANGE OF 35 STANDARD MODELS, SINGLE OR DOUBLE ACTING FROM 230 PSI WITH OUTPUT FROM 3,360 CU. INS. PER MIN.

- Air-Hydro-Pump is the finest pressure unit for rapid testing of valves, boilers, piping pressure vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis or Acids can be used.
- Made of non-ferrous metals.

Also 4 JUNIOR MODELS

Weight 20 lbs. Size 8" x 16"
Air pressure 100 psi. Fluid pressures 2,500—4,500—6,000—10,000—
$168.50 f.o.b. New York.

DAVIES BROS. 120 WALL ST., N. Y. 5, N. Y.

Specify AIRMATIC QUALITY FOR:

1. FLOW CONTROL VALVES

2. SEQUENCE VALVES

3. PRESSURE REGULATORS

4. CYLINDERS

5. SOLENOID VALVES

Write for Complete Details about AIRMATIC Products

Attractive O.E.M. and Quantity Discounts

Delivery from Stock —Immediate

AIRMATIC VALVE, INC.

7317 Associate Ave. • Cleveland 9, Ohio

Post Scripts of Industry

News about people, manufacturers and sales organizations

Richard T. Coyne
National Motor Bearing Co.

Richard T. Coyne, former vice president of the **Pressed Steel Car Company,** has joined **National Motor Bearing Co. Inc.** as assistant to the president. He will make his headquarters at National Motor Bearing's Chicago Field Building offices and will be concerned with marketing and servicing company products for railroads. Coyne is widely known among railway men and members of the American Association of Railroads. He has been active in the sales and promotion of railway rolling stock and equipment for many years. His experience includes sales and executive responsibilities.

James E. McComb
Miller Fluid Power Co.

With several years experience in **Miller Fluid Power Company's** order processing and sales engineering departments, **James E. McComb** has been appointed as the company's new field engineer for the San Francisco area. McComb's former duties in sales engineering have been assumed by **Don L. Boox,** transferred from the order processing department. **Terry Morris** has been advanced from the production control department to assume Boox's former duties.

Allen A. Aiman
The Parker Appliance Company

Appointment of **Allen N. Aiman,** as sales engineer in the Cincinnati territory for "O" rings and related rubber products is announced by **The Parker Appliance Co.** From headquarters at 214 E. 8th Street, Cincinnati, Aiman will cover Kentucky and the southern parts of Indiana and Ohio. He will work with distributors in this area, including J. N. Fauver Company, Dayton, Ohio and Avels Sales and Engineering Company, Indianapolis, Indiana. He will be under the direction of Tommy J. McCuistion, sales manager of the rubber products division in Cleveland. Also announced was the promotion of **R. Gurden Miller,** formerly sales engineer in Connecticut and Rhode Island, to district manager for Michigan. As representative for tube and hose fittings, and industrial hydraulic components, Miller will also work closely with the established authorized distributor for Michigan, J. N. Fauver Company, in Detroit.

M. S. Clark, president, **Snap-Tite, Inc.,** Union City, Pa., announces the appointment of **The Rucker Company,** 4516 Hollis St., Oakland, California as exclusive distributors of the Snap-Tite quick connect-disconnect couplings in six western states. The engineering services of the Rucker organization will be available for applications of Snap-Tite products in California, Oregon, Washington, Idaho, Nevada and Arizona.

Joy Manufacturing Company, announces the election of **John Lawrence** as executive vice president. He will give special attention toward further diversification of the company's product lines. Lawrence joined the company in 1951 as vice president of manufacturing and in 1953 was named vice president of manufacturing and engineering. His prior experience includes several years with SKF Industries, as vice president.

The Fulflo Specialties Co. announces the appointment of **Hayden and Company,** 53 W. Jackson Blvd., Chicago, as their representa-

Let this unique illustration convey to you the remarkable cooling effect of Howell's new internal ventilation system in Series 100 Motors.

New Howell re-rated motors run cooler... last longer

Your motor needs have changed just as your machines have changed. Here are *completely new* motors . . . designed and built to meet *today's* requirements!

Now! Howell brings you everything you want in a re-rated motor: smaller size and lighter weight . . . plus *better cooling* for less maintenance and longer life.

Howell Series 100 re-rated motors feature a new internal ventilation system that provides 50% more contact between cooling air and active lamination materials. Temperature ratings are easily maintained; overload capacity is increased.

Many New Features

Series 100 Motors offer many other advantages: *They take up less space* – up to 30% less in some sizes; both open and totally enclosed fan-cooled motors have same diameters. *They perform better* – Howell uses dependable copper rotors for higher conductivity, greater flexibility; new Mylar* slot insulation is thinner (more space for copper windings), yet eight times stronger. *They last longer* – better cooling, double-shielded bearings and super tough steel frames and feet, with cast iron endplates, insure extra years of trouble-free performance. *They fit your special needs* – Howell provides rotors in three diameters for each frame size; corrosion-resistant materials and fittings are available to meet your specific industry problems.

Before you buy any re-rated motor, compare Howell Series 100 Motors for modern design, outstanding performance, and engineered precision. Howell will continue to make a complete line of regular and special motors – we have in our files more than 20,000 electrical design specifications! Let us serve you. Call your Howell man today.

*DuPont trade mark

HOWELL MOTORS

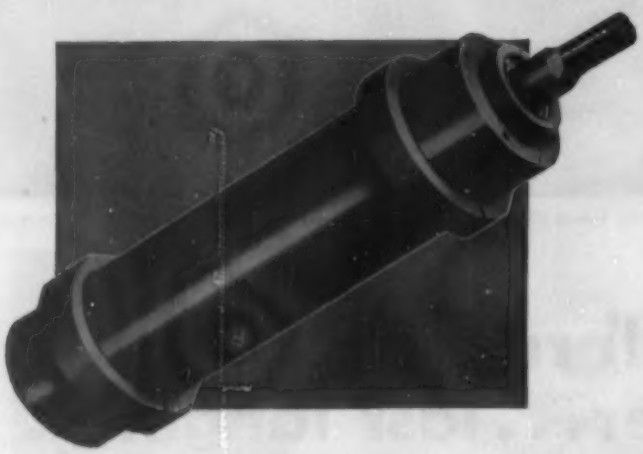
Howell Electric Motors Company, Howell, Michigan

MOTORS FOR INDUSTRY SINCE 1915

tives in the sections of Indiana, Illinois and Wisconsin covered by the Chicago area.

Lockheed Aircraft Corp. has announced that it has appropriated a fund of $10,000,000 to finance establishment of a new scientific laboratory for advanced research by its missile systems division. Eminent scientists, many of whom are nuclear physicists are already on the job. Heading the research laboratory will be **Dr. E. H. Krause,** widely known nuclear physicist, who resigned as associate director of research at the Naval Research Laboratory in Washington to join Lockheed. Dr. Krause will be joined in the lab by **Dr. Montgomery H. Johnson,** named associate director. Dr. Johnson is an authority in atomic and nuclear physics. He was formerly at the University of California Livermore Laboratory. He has also served on the Massuchusetts Institute of Technology Radiation staff.

FOR LOW MAINTENANCE
Westinghouse Type "A" Pneumatic Cylinders



● Maintenance is no problem with these streamlined Westinghouse Type "A" Pneumatic Cylinders. They have only a few wearing parts, and *all* parts are strong and durable to assure long life in hard service. A wrench grip on the push rod makes servicing easy and adds to the life of the rod.

Westinghouse Cylinders are built with or without cushioning. They are light, compact and fast acting.

Standard construction is steel but for corrosive uses, brass bodies and stainless steel push rods can be supplied.

Diameters run from 1½" to 10" with strokes from 1" to 42"—and longer if push rod is in tension. Units can be foot-mounted, flange-mounted, or pivot-mounted.

Write for booklet 9308-2

Westinghouse Air Brake
COMPANY

INDUSTRIAL PRODUCTS DIVISION WILMERDING, PENNSYLVANIA

Pneumatic cylinders, valves, engineered pneumatic systems and air control devices of all kinds.

Factory Branch: Emeryville, Calif. Distributors throughout the United States . . . see your Classified Directory. Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario

A geographical realignment of sales divisions and a number of changes in top sales personnel are announced by **Micro Switch,** a division of **Minneapolis-Honeywell Regulator Company.** Under the new set up, there will be two sections, eastern and western, with a sales manager in charge of each. **Emmett N. Hughes,** former west coast division manager, will be western sales manager in charge of all sales operations on the west coast, including the Rocky Mountain states. He will be headquartered in Los Angeles. **John K. Lincoln** will be eastern sales manager, in charge of sales operations in all states east of the Rocky Mountains. He will headquarter in Freeport. **Anderson Wacaser,** former central division manager with headquarters in Cleveland, will be transferred to the home office to head up market research, a new section in the sales department.

Dorothy M. J. Tracey was elected president of **Tomkins-Johnson Co.** She succeeds her father, the late A. R. Johnson. Mrs. Tracey has served for a number of years as executive vice president and general manager.

G. H. Weight has been appointed southwest district sales manager of the **Tubular Products Division of The Babcock & Wilcox Company.** Weight has been attached to the Chicago sales office of the division prior to his promotion. In his new position, Weight will have charge of the division's sales office in Houston, Tex. and Tulsa, Okla. and will supervise the sales of the company's seamless and welded steel tubular products in the area. His territory will include the states of Texas, Oklahoma, Arkansas, Mississippi, Louisiana and southern Kansas.

COMPRESSION?

INJECTION?

TRANSFER?

. . . OR LINEAR "ROTO-MOLDED"!

Here are the straight facts about "O" rings

Only *compression-molding* produces "O" Rings with the uniform cure and grain structure . . . flash-free finish . . . and precise, uniform tolerances so necessary in modern sealing applications.

"O" Rings produced by injection or transfer methods have, in the past, enjoyed some advantages in applications where price was the deciding factor.

Today this advantage no longer exists!

LINEAR, with a revolutionary, new, high-speed process now produces true compression-molded "O" Rings at a rate and cost not possible with injection molding or transfer methods.

This process, known as "ROTO-MOLDING", provides all these superior features—regardless of the compound used:

1. Superior flash-free finish.
2. Far closer dimensions than ever before possible by *any* molding method.
3. Superior physicals.
4. Greater resistance to distortion under hydraulic or pneumatic pressure.
5. Greater resistance to abrasion.

There's no need to compromise with the finest quality, when the finest now costs no more! Get full facts today on LINEAR ROTO-MOLDED perfect circle "O" Rings in a variety of sizes and materials.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

Post Scripts of Industry

R. B. Grant has been appointed Los Angeles branch manager for **Minneapolis-Honeywell Regulator Company.** Since 1949, he has been regional industrial manager for the Pacific region. Grant joined the company fourteen years ago.

Appointment of **Flow Engineering Sales Company,** 405 Woodland Drive, Birmingham 9, Alabama as authorized distributor for **The Parker Appliance Company** tube fittings and related products has been announced. Working with this new distributor and providing technical assistance as needed, will be **Lewis C. Ely,** district manager in the southeastern area. The appointment of **Florida Metals, Inc.** as authorized distributor for hydraulic hoze-lok fittings and hose assemblies is also announced. Florida Metals maintains warehouses in Tampa, Jacksonville and in Miami. Working with the distributor, will be Lewis C. Ely.

EVERYTHING YOU NEED IN LOW CARBON STEEL HYDRAULIC TUBING

Hydraulic carbon steel tubing in standard outside diameters from ⅛" to ½" is stocked by Superior distributors for shipment without delay. Your tubing distributor will be glad to quote you prices and delivery—and help you select proper tubing for your particular application. Please use the coupon below.

For more efficient than pipe, Superior tubing is the modern fluid handling circuit. Proper tube fittings offer tighter joints resulting in leak-proof systems. Smooth interior and sweeping bends mean less back pressure and internal friction. Freedom from these handicaps means greater over-all safety in operation.

The bending qualities of Superior Hydraulic tubing permit long, gradual bends and close radii bends where conservation of space is needed. The smooth exterior permits uniform contours and neater bends. Tubing is furnished in dead soft annealed temper Ø1 which offers desired strength properties and ease of fabrication.

Each lot of Superior tubing gets the flareability test required by the new SAE specification for carbon steel hydraulic tubing. A section of tube approximately 4" long is expanded over a mandrel having a 60° angle until the inside diameter is increased 30%. Each lot is also hydrostatically pressure tested.

Non-aging carbon steel hydraulic tubing is now produced to a new SAE specification. Available in lengths up to 28 feet, with the high physical and mechanical properties obtained by cold drawing, it offers better workability than ordinary steel tubing. Sizes from ¼" to 1⅛" O.D. are available—with wall thicknesses that permit internal working pressures ranging up to 9,000 psi.

Superior Tube

The big name in small tubing

All analyses .010" to ⅛" O.D.
Certain analyses in light walls up to 2½" O.D.

Superior Tube Company
2030 Germantown Ave., Norristown, Pa.

Please send me at once your newest folder on Superior Hydraulic Tubing.

Name.....
Title.....
Firm.....
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City..... State.....

Robert Hoffman
General Dynamics Corp.

Robert Hoffman, has been named western regional manager for the **Electro Dynamic Motor-Generator Division of the General Dynamics Corp.** Hoffman's experience in electric motors totals seven years as salesman and as a district sales manager.

Robertshaw-Fulton Controls Company has announced its new Canadian subsidiary has acquired a modern manufacturing plant in the Toronto area, and plans to start operations soon. The decision to undertake manufacture of certain of the company's products in Canada was dictated by the expanding needs of Canadian industry.

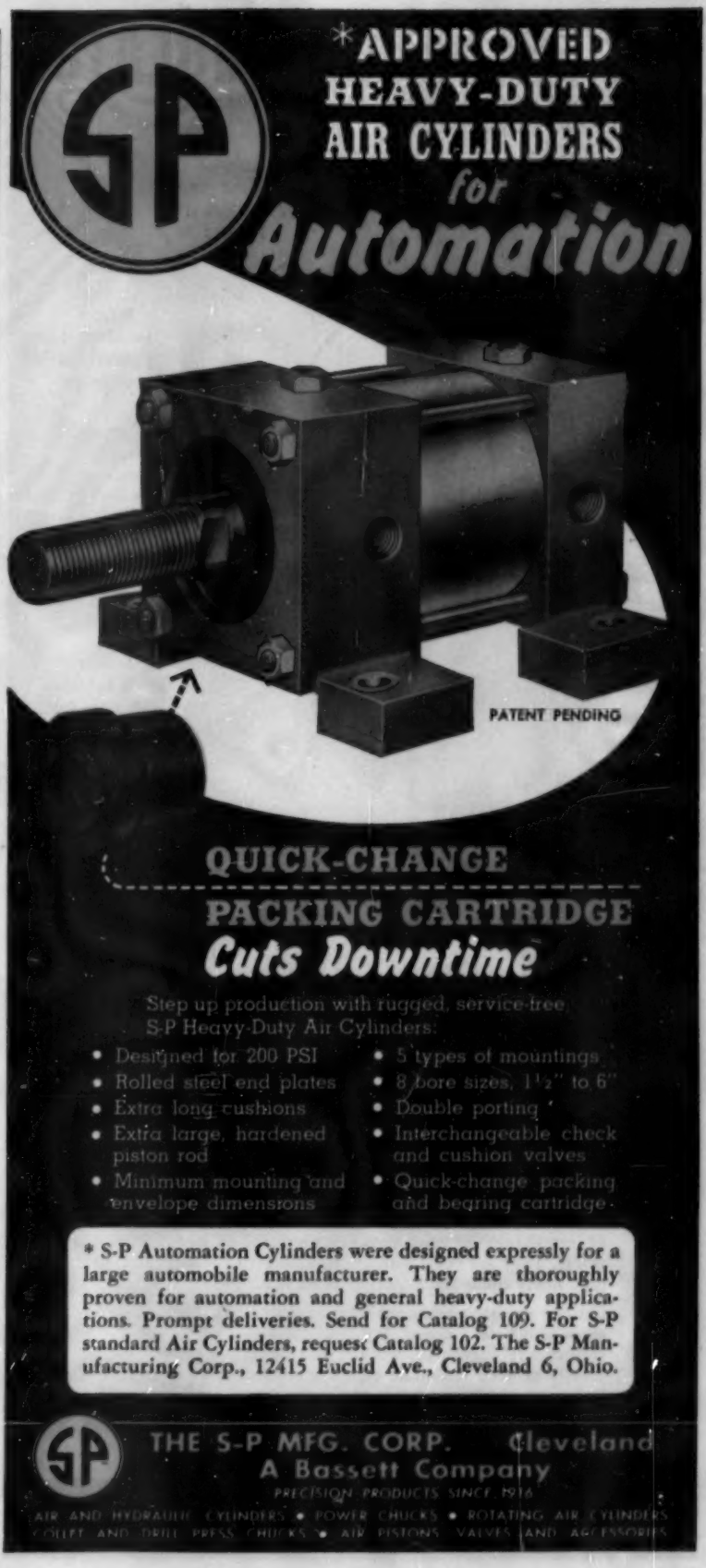
John J. Fegan, Jr., whose appointment as sales engineer for **Nielsen Hydraulic Equipment, Inc.** was recently announced, will handle the Buffalo-Rochester-Syracuse area for the company. He has been employed by the Whitehead Metal Company for a long tenure of service and was sales engineer for The Parker Appliance Company.

The Hydraulic Press Mfg. Company has announced the appointment of two new distributors. They are **The Mine and Smelter Supply Company** of Denver and El Paso and the **Todd Machinery Company** of Salt Lake City. At the

Denver office of The Mine and Smelter Supply Co., **Stacy C. Hinkle** is general manager; **Lewis W. Grove,** Denver branch manager; **W. J. Edwards,** machinery manager. **George T. Brady** is branch manager at El Paso and **Louis Laurel** is machinery manager. **Harry J. Todd** is manager of the Todd Machinery Company.

The Sealol Corporation, will move their Providence manufacturing operations in November to a new plant located in Warwick, Rhode Island, in the new Warwick Industrial Park area. The new plant will be ultra modern in every respect, with soundproof ceilings, and a single floor plan having window area. The building is now under construction and will provide 30,000 sq ft of space. This is the third major expansion for the Sealol Corp. within the past ten years. In addition to this new plant, the company will continue to operate its complete manufacturing facilities in Keene, New Hampshire which consist of approximately 30,000 sq ft. of manufacturing space. The new plant will house not only the manufacturing facilities but also the general administrative offices of the corporation and the headquarters of the sales and engineering departments. Approximately 4,000 sq ft of space will be available in the new plant for increased activity in research and development under the guidance of **Ralph Kroekel** who is director of a newly established research and development department.

General American Transportation Corporation of Chicago has announced the execution of a contract for the acquisition of the **Fuller Company** of Catasauqua, Penn., manufacturer of air compressors. The transfer includes Fuller Company's wholly owned subsidiaries, Hershey Machine & Foundry Company of Manheim, Pa. and Separation Process Company of Catasauqua. The active management of Fuller Company will be under **A. E. Douglass, Sr.,** president; **G. K. Engelhart,** vice president; **J. H. Morrow,** vice president; **C. O. Davis,** general manager; **H. C. Wolbach,** treasurer; and **A. S.**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Step up production with rugged, service-free S-P Heavy-Duty Air Cylinders:
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* S-P Automation Cylinders were designed expressly for a large automobile manufacturer. They are thoroughly proven for automation and general heavy-duty applications. Prompt deliveries. Send for Catalog 109. For S-P standard Air Cylinders, request Catalog 102. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.
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AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
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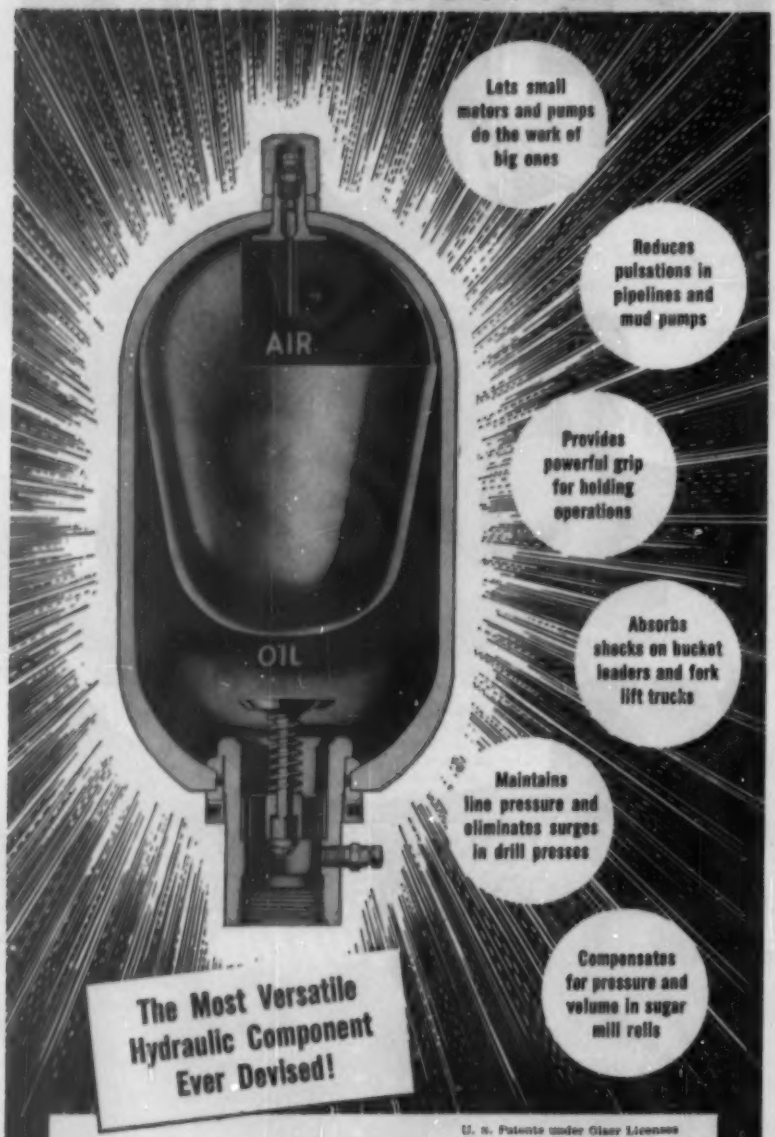
THE GREER ACCUMULATOR


Lets small motors and pumps do the work of big ones
Reduces pulsations in pipelines and mud pumps
Provides powerful grip for holding operations
Absorbs shocks on bucket loaders and fork lift trucks
Maintains line pressure and eliminates surges in drill presses
Compensates for pressure and volume in sugar mill rolls
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The Most Versatile Hydraulic Component Ever Devised!

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Today, Greer Accumulators are found in every conceivable hydraulic circuit — the few applications mentioned above show tremendous diversity of use. Their wide acceptance is due to these important reasons. 1) simple operation, 2) ease of installation, 3) minimum maintenance, 4) *and complete safety*. They are rugged and dependable, too — each built to take many times the expected work load.

Let our experienced application engineers show you how a Greer Accumulator can reduce the cost, size, weight and complexity of your hydraulic equipment. Our Brochure 301-A gives you technical data on the Greer Accumulator. Write or call today for your free copy. No obligation.

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Field offices in Chicago, Dayton and Detroit • Sales Representatives in all principal cities

Post Scripts of Industry

Heffelfinger, secretary, all of whom have served the Fuller Company in official capacities for many years. J. W. Fuller and C. Thomas Fuller, the principal owners, will retire from their positions of president and vice president, respectively, to devote their time to the management and further development of their cement interests, particularly the Allentown Portland Cement Company, which is not involved in the present transaction. Fuller Company will continue to operate as an independent corporation under the same name, with its engineering and manufacturing operations continuing in its present offices and shops.

Robert Grand
Grand Air-Hydro Div.
K. William Ostrum Co.

Appointment of the **Grand Air-Hydro Division** of the **K. William Ostrom Co., Inc.** in Philadelphia and Baltimore areas has been announced by **Fluid Controls, Inc.** The division will distribute the complete line of Fluid Controls' check needle, restrictor relief valves and flow regulators. The division will have the advantage of using K. William Ostrom Company's complete office and shipping facilities. Robert Grand, head of the division, has more than eight years' experience in assisting manufacturers in that area.

Manufacturing and sales rights for all products previously made by **Standard Controls, Inc.** of Seattle, Washington, have been taken over by **Cadillac Gage Company**

of Detroit. These products include a line of hydraulics and pressure control valves widely used in the aircraft and guided missile industries. Because of the high precision manufacturing experience and the recent acquisition of a new larger plant equipped with the most modern of precision manufacturing equipment, it was thought best, to concentrate manufacturing in Detroit and devote the facilities of the west coast exclusively to research and development as a service to the aircraft and missile industry. The new plant of Cadillac Gage more than doubles the area of the older plant.

The appointment of **Richard J. Zobel,** as Philadelphia district manager for **Sterling Electric Motors, Inc.,** was announced. Zobel had previously been serving the area as an application engineer.

John H. Muth and **Dean O. Phillips** have assumed new duties as field engineers for **Miller Fluid Power Company,** in the Cleveland, Ohio territory. Before joining the company, Phillips had fourteen years of industrial experience in engineering and design, production management and supervision.

Appointment of **Charles Brunell** as vice president in charge of sales of **Cook Electric Company,** has been announced. Brunell has been manager of the company's diaphlex division since 1949. **Daniel Shevelenko** will succeed Brunell as diaphlex division manager.

Luther Harris has been made division general manager of the **Aircraft Service Division of Lear, Inc.,** and **Alan H. Blair** has been appointed sales manager of the Aircraft Service Division. Harris comes to Lear from Aircraft Engine and Parts Company of New York, where he has for two and one-half years been executive vice president. Prior to joining the company, he was employed by Lockheed Aircraft Corp. Also appointed is **Robert Boyer, Jr.** He has joined LearCal Division as military sales manager. Boyer will be responsible

GREER TOPICS

Important News of Aviation & Industrial Test Equipment

Greer Stationary Hydraulic Accessories Test Stand, shown here in Ford's Kansas City Aircraft plant, provides a shop type machine to fully check hydraulic system accessories including system pump at flow rates up to 20gpm and at pressures up to 3400psi.

Greer Dual Hose Tester, used for B-47 hose lines, checks from one to six hose lines or similar production components with pressures to 25,000psi in covered burst chamber.

Greer Portable Hydraulic Test Machine provides hydraulic test fluid for checking hydraulic systems of modern aircraft. Handles flows up to 20 gpm and pressures up to 3400psi.

How Greer Helps Ford

Greer Test Machines check complex B-47 components at Ford's Kansas City plant

The Ford Motor Company's entire history is one of quality products, economically produced. One of the reasons for Ford's extraordinary record has been its high standard of quality control.

To help maintain these high standards in the manufacture of aircraft components, Greer test equipment is at work in Ford's Kansas City aircraft plant. Complex B-47 components are put through rigorous inspection to determine their air-worthiness.

Walk into virtually any plant in the aircraft industry and you'll find Greer equipment at work. Most of the units are standard equipment ordered directly out of a catalog (yours on request). Other units were specially built to out-of-ordinary specifications by the famous Greer engineering department. These men are ready to go to work for you.

GREER
TEST EQUIPMENT

Greer Hydraulics Inc., International Airport, Jamaica 30, New York

Field Offices: 1900 West Cermak Road, Chicago Illinois • 25 South Main Street, Dayton, Ohio 2832 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities

for all LearCal sales to government agencies, both as regards products and also research and development contracts.

The modern 424,000 sq ft factory owned and operated by **Fairchild Engine Division** is being purchased by the neighboring jet plane builder, **Republic Aviation Corp.** Negotiations have been in process for some time on the purchase, undertaken to improve the national defense production potential of both companies; acquiring the present Fairchild factory and office building comprising approximately 17 acres, will give Republic room to consolidate essential engineering and experimental operations closer to home. Building of a new factory by Fairchild will provide space for its new laboratory and room for expansion in case of immediate need. Fairchild will relocate at an unannounced site in Suffolk county, a location reported to have many more advantages for its employees than the present plant. This move will not affect the status of the firm's two Nassau county plants.

Richard L. Bedell has been appointed branch manager of the Rochester, New York office, according to an announcement by **Sterling Electric Motors, Inc.**

L. G. Kranick
Wisconsin Hydraulics, Inc.

L. G. Kranick, president announced the change in the name of **Milwaukee Metal Working Company** to **Wisconsin Hydraulics, Inc.** For more than 50 years the company has manufactured hydraulic motors, pumps, valves and cylinders.

Edward H. Heath has been appointed manager of quality control at **Howell Electric Motors Company.** His duties will include supervision of inspection and coordination of production and quality control. Prior to joining Howell, he was chief engineer at Marathon Electric Corp., Erie, Pa.

Farris Engineering Corp. announces the appointment of **Robert N. Gierse** as sales manager of the **Farris Flexible Valve Corp.** For more than 5 years, Gierse was industrial sales manager in the Instrument Division of Thomas A. Edison, Inc. His experience also includes 20 years with The United States Gage

REMOTE
Cylinder
CONTROL

with
Ledeen
POWER operated VALVES

Hand Valves

Foot Valves

Instant action of remotely located or automatically operated cylinders is made possible with the new and improved Ledeen Power Operated Valves. These disc-type valves are positive in operation, and are readily adaptable to a wide variety of pilot controls. Solenoid operated power valves are available as complete package units.

Ledeen Power Operated Valves are fast cycling, have few moving parts, and require very little maintenance. They are available from stock for quick delivery.

Write for Bulletin 1010.

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VALVE ACTUATORS
AIR HYDRAULIC
PUMPS & BOOSTERS

Ledeen Mfg. Co.
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Los Angeles 15, Cal.

Division of American Machine and Metals, Inc. where he held various positions in sales engineering.

Promotion of **Robert R. Dickey,** formerly sales engineer in Baltimore, to district manager in upper New York state is announced by **The Parker Appliance Company.** As representative for tube and fittings and industrial hydraulic components, Dickey will also work closely with Whitehead Metal Products Co. a Parker distributor in Buffalo and Syracuse.

Chain Belt Company announces the opening of three new district sales offices. An office at Charlotte, North Carolina, has been opened under the supervision of **Ray Traylor.** Another office was established in Cincinnati. **Charles Stanton** is district sales manager there. A third area sales office is now operating in Moline, Illinois. This office is under the supervision of **Bruce Genzel.** All men assigned to the above offices have been trained as sales engineers by the company.

Chain Belt Company announces the appointment of six sales engineers to their district sales offices. The newly trained engineers are, **Tom Jewell, Jim Collins, Deane Treat, Ray Tippett, Jerry Plant** and **Henry Kozlowski.** Their respective district office assignments are with Milwaukee district sales, San Francisco warehouse and district sales and sales offices in Dallas, Philadelphia, Los Angeles and Chicago. The six men have completed an intensified 14 week training course at the company's home plant in Milwaukee.

Raybestos-Manhattan, Inc., has announced the appointment of **Flow Products, Inc.,** 5656 West Diversey Ave., Chicago, Illinois, as an authorized distributor of the company's packings.

Dr. Wayne E. Kuhn has been named general manager of the newly created research and technical department of **The Texas Company.** Dr. Kuhn had been manager

The Electrol Check Valve
Prevents Reversal of Flow in { Air... Oil or Water Applications

Diagram showing internal construction of the Electrol (463FP) Check Valve.

The Electrol (463FP) Check Valve is ideally suited for heavy-duty service applications — providing positive sealing against return flow in air . . . oil . . . or water control lines, with a minimum of pressure drop. It has a maximum operating pressure of 5000 P. S. I., with a cracking pressure — in free flow direction — from 2 to 8 P. S. I. Elements are of brass and bronze —and include a patented O-ring check seat. Write today for complete engineering data.

Better Designed Products Use Electrol Hydraulics

Electrol INCORPORATED HYDRAULICS
KINGSTON, NEW YORK

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

of the company's technical and research division since 1938. Until recently the research organization had functioned as a division of refining. Also appointed is **James T. Maher** as general staff assistant in public relations. For the past four years, Maher has been a member of the public relations department of Cunningham and Walsh Inc., where he handled Texaco's technical and product publicity. In his new assignment he will continue to publicize the research, products and services. He will be located in the company's New York headquarters.

H. E. Kaye, assistant chief engineer, Rollway Bearing Company, Inc., has been named chairman for the next year of the Roller Bearing Engineering Committee, **Anti-Friction Bearing Manufacturers Association.** Together with the annular bearing engineering committee, Kaye's committee will administer an industry wide program to standardize the limits, capacities and other engineering characteristics of anti-friction bearings.

At the annual meeting of the board of directors of the **Webster Electric Company,** the following officers were elected. **S. A. Loeb,** formerly chairman of the board, to chairman executive committee; **Arthur C. Kleckner,** formerly president, to chairman of the board; **Preston G. Crewe,** formerly executive vice president and treasurer, to president and treasurer; **David J. Munroe,** formerly vice president, manufacturing and engineering, to executive vice president.

A new combined sales office has just been opened by the **New York Air Brake Co.,** at 90 West Street, New York, N. Y., to give its eastern customers the benefit of the centralized facilities of all divisions of the company—the **Kinney Mfg. Co., Dudco Division, Hydreco Division, Aurora Pump Co.,** and the **Watertown Division. Lynn R. Parrish,** vice president and regional branch manager of Aurora will head the sales force for the Aurora Pump Co. **William Chester** will represent the Kinney Division as branch manager and **William Amory** will handle the eastern territory for both the Dudco and Hydreco divisions. The new office is not a departure from the parent company's standing policy of conducting sales through divisional sales organizations. It is intended solely to give the individual divisions common offices, coordinated sales facilities and warehouse space which will give eastern customers faster delivery of products from all divisions.

W. D. Morrison has been named assistant to the director of the development department of **Celanese Corp. of America.** Until his promotion, Morrison for the last two years was assistant manager of the product development department of the Chemical division.

HIGH PRESSURE PUMP

air driven... for pressures to 30,000 psi

Use for hydraulic presses and other hydraulic machines for clamping, riveting, crimping, shearing and punching. Applicable also for hydrostatic testing and other high-pressure, low-volume service.

• Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models as listed in table. Special models for lower or higher pressures. Applicable wherever low-volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.

Model No.	Maximum Input Air Pressure	Nominal Ratio	Discharge Pressure at 100 PSI. Input Air Pressure	Prices, F.O.B. Gardena, Calif.
S-216-C- 10	150 PSI	10:1	1,100 PSI	$220.00
S-216-C- 20	150 PSI	20:1	2,100 PSI	210.00
S-216-C- 35	150 PSI	35:1	4,600 PSI	173.25
S-216-C- 60	150 PSI	60:1	6,600 PSI	173.25
S-216-C-100	150 PSI	100:1	8,800 PSI	173.25
S-216-C-150	150 PSI	150:1	15,200 PSI	194.50
S-216-C-200	150 PSI	200:1	23,750 PSI	225.00
S-216-C-300	100 PSI	300:1	33,500 PSI	289.50

SPRAGUE *Engineering and Sales Corp.*

1144 WEST 135TH STREET, GARDENA, CALIFORNIA

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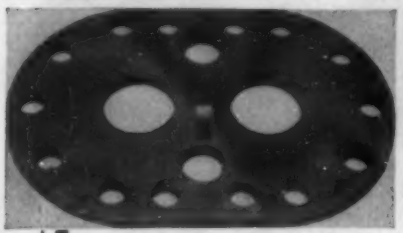
This Pump Thrust Plate Was Made From Promet No. 6-SK Bronze Alloy



To increase pressures and volumetric output, manufacturers of gear type, oil hydraulic pumps must use long-wearing, accurately machined bronze plates with surfaces held parallel and uniform within .0005".

American Crucible is regularly doing such jobs for pump manufacturers, holding tooling charges to a minimum through the use of Universal-type jigs and fixtures.

Names of satisfied customers on request. For full details on Promet Bronze Pressure or Wear Plates and Bronze Packing Nuts write

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Only **Carpenter Needle Valves** offer combinations of inlet and outlet connections to meet the requirements of **every** fluid power piping or tubing layout. Designed by practical hydraulic engineers for practical hydraulic installations, they permit maximum economy of space. **Carpenter Needle Valves** are available in complete range of sizes with brass, steel or stainless steel forged bodies, all with stainless steel stems. Send for literature and prices on **Carpenter Valves** *today.*

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SIZES: 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 1 | 1 1/4 | 1 1/2 | 1 3/4 | 2

CHECK VALVES

☐ Standard Full Check
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SIZES: 1/4 | 3/8 | 1/2 | 3/4 | 1

CYLINDERS

☐ Hydraulic
☐ Pneumatic

STOCK BORES: 1 1/2 | 2 | 2 1/2 | 3

HOSE ASSEMBLIES

☐ One Wire
☐ Two Wire
☐ Rayon

SIZES: 1/4 | 3/8 | 1/2 | 3/4 | 1

Name _____
Firm _____
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Mail it TODAY!

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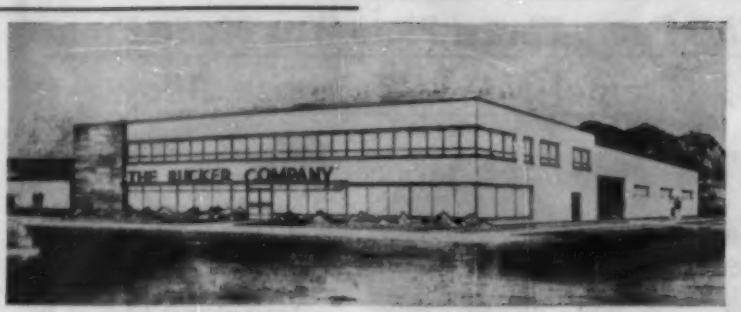


A $200,000 expansion program was initiated recently by the **Rucker Company,** with the construction of a new warehouse and plant building. When completed about November 1st, the two story modern concrete structure will cover 21,000 sq ft of floor space. It will provide for expanded fabrication and shop facilities and increased warehousing for distribution operations. The building will also enable the firm to consolidate all phases of operations under one roof. At present, the company maintains two different buildings.

The Graton & Knight Company has announced the opening of a new Detroit Branch office at 16146 Wyoming Street. This office was formerly at 1627 West Fort Street. The new office will also serve as branch office for International Packings Corp. a Graton & Knight subsidiary. Branch manager of the office will be **Robert C. Kerr.**

The Cushman Chuck Company has announced the appointment of **Frederick H. Fippinger** as their New England sales representative. Fippinger has been with the company since 1936 and for the last eight years was their factory manager in complete charge of the entire manufacturing operations and personnel.

Electrol Incorporated has announced the appointment of **Edwin H. Schmitz** as executive vice president.

To serve industrial customers in Ann Arbor, Michigan and surrounding areas, **The Bellows Company** has established a new sales office at 330 Municipal Court Building, Ann Arbor. **Daniel J. Gurta** has been appointed the field engineer in charge of the office.

Robert C. Houser has joined H. K. Porter Company, Inc., as assistant treasurer.

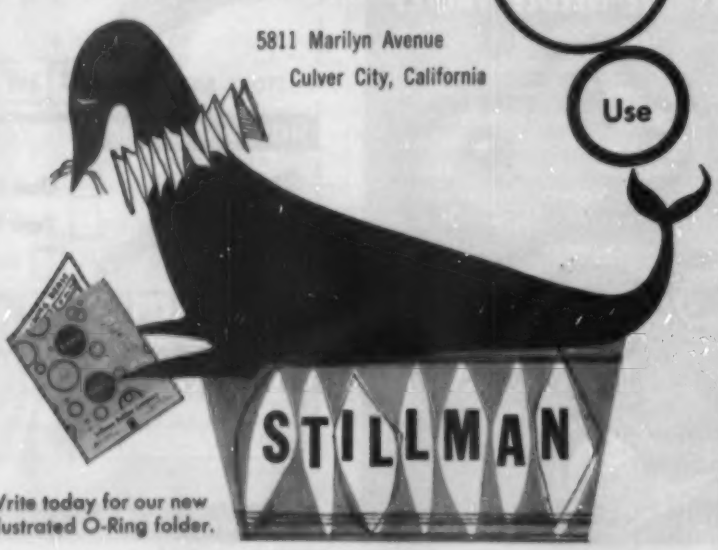
WORLD'S BEST PERFORMING SEAL

Not all performing seals are in the circus! The very best are in Stillman's new series of top-quality, top-performing Industrial O-Rings. They last longer, seal better, come in all sizes, with no breakage or discards—no O-Rings in the trash can. Yet they cost no more than any other Industrial O-Ring anywhere. Each Stillman O-Ring is a faithful performer, just like seals in the circus. Investigate and see for yourself.

Stillman Rubber Co.

5811 Marilyn Avenue
Culver City, California

O-Rings for Industrial and Commercial Use



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COMPACT **DEPENDABLE** **EFFICIENT**

Piston Style, Double Acting
BHEW Hydraulic Cylinder

OPTIONAL MOUNTINGS

It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

BHEW

Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.

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BENTON HARBOR, MICHIGAN

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH

The New

CAPITAL HYDRAULIC OIL FILTER

WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL · EASY TO CLEAN · LONG LIFE · LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

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...TH S.S. WHITE PLASTIC CLOSURES

- For threaded and unthreaded parts and openings.
- Easy to apply—easy to remove. Once on—*they stay put.*
- Use them to—
  - —Seal out dirt, moisture and dust
  - —Seal in fluids and lubrication
  - —Protect threads
- Immediate deliveries of a wide range of standard sizes.

PLAIN ELASTOPLASTIC PLUGS AND CAPS

Seal flush to permit easy stacking of parts. Unaffected by oil, grease or gasoline. Made of tough, rubberlike plastic.

THREADED PLASTIC PLUGS AND CAPS

Cleanly molded threads assure easy application. Provide safe, sure positive protection to threaded parts. Unaffected by most petroleum base products.

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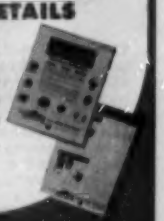

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Circle 178 on Reader Service Card

Post Scripts of Industry

The first meeting of the 1954-55 season of the **Fluid Power Systems Division** of the Philadelphia Section of the ASME was held on Thursday, September 30 at the Engineers Club, Philadelphia. V. V. Blasutta, Vice President and Director of Engineering, Denison Engineering Company, spoke to a large audience on "High Pressure Hydraulic Application Problems". There was an active discussion under O. S. Carliss, Chief Engineer, Yale & Towne Mfg. Co. J. S. Bennett, Vice President, American Engineering Company, acted as chairman of the meeting.

James C. Walton, former assistant general manager and director of manufacturing of the Boston Woven Hose & Rubber Company, has resigned to become a director and vice president in charge of production of the **Bellofram Corporation.**

R. B. "Bob" Wilson, formerly industrial sales engineer in northern New Jersey for **The Parker Appliance Company,** has been made sales engineer for Parker "O" rings and related rubber products in upper New York state and all of New England excepting Connecticut. In his new assignment, Wilson will be under the direction of Tommy J. McCuistion, sales manager of Parker's rubber products division. Wilson will work closely with authorized "O" ring distributors in his territory including Hercules Gasket and Rubber Company, 327 Washington Street, Buffalo, and Irving B. Moore Corp., 65 High Street, Boston, Mass.

The Air and Hydraulic Division of **Lindberg Engineering Company,** Chicago has moved its Detroit Sales Office to the Lindberg Detroit Building at 1220 S. Woodward Ave., Royal Oak, Michigan. Complete sales and service functions for heat treating furnaces, high frequency heating units, and air and hydraulic cylinders are now centered at this location.

Appointment of **Albert W. Agnew** as district manager for the area served by **Vickers, Inc.** El Segundo and Berkeley, California field offices is announced by F. T. Harrington, vice president-sales. In his new capacity Agnew will have charge of all sales of Vickers industrial and mobile products in Los Angeles, San Francisco, San Diego, Salt Lake City and Phoenix areas.

The Columbia Steel & Shafting Company, Pittsburgh, has announced the appointment of **Lee D. Phillips** as sales representative in the company's Philadelphia-New York territory. Phillips was formerly employed by Hoffman Industries, Reading, Pennsylvania. Prior to that he was associated with the sales department of the Summerill Tubing Division of Columbia Steel & Shafting Company.

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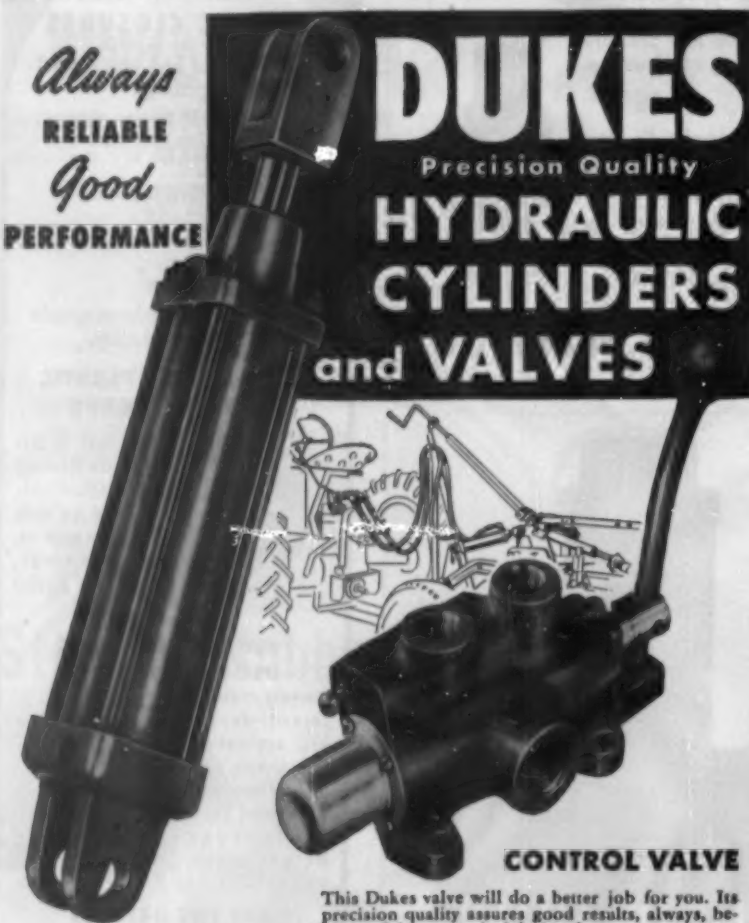

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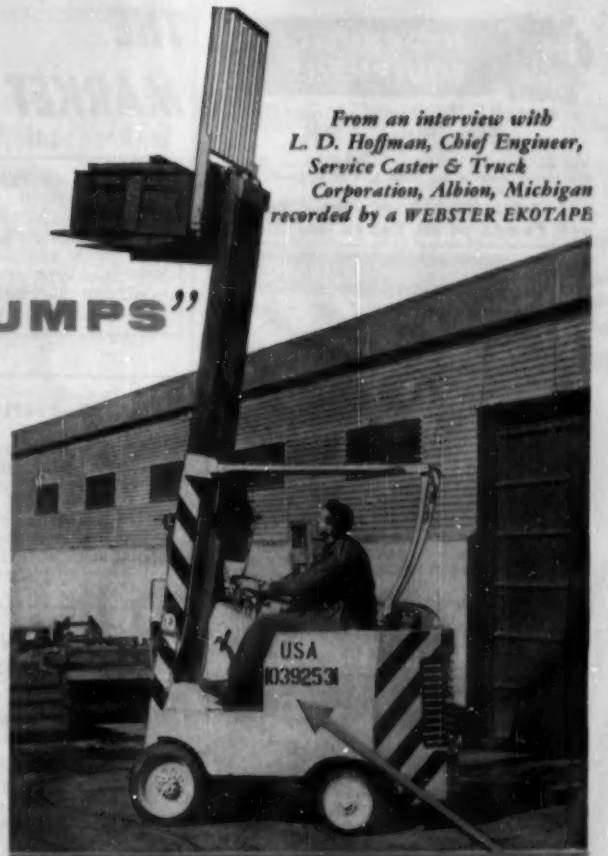
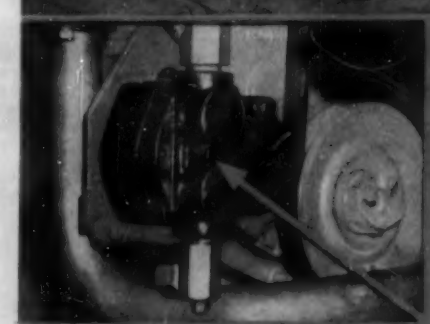
From an interview with L. D. Hoffman, Chief Engineer, Service Caster & Truck Corporation, Albion, Michigan recorded by a WEBSTER EKOTAPE





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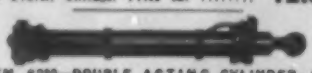

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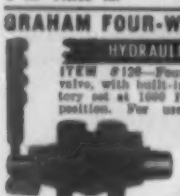

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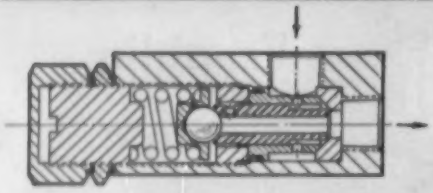

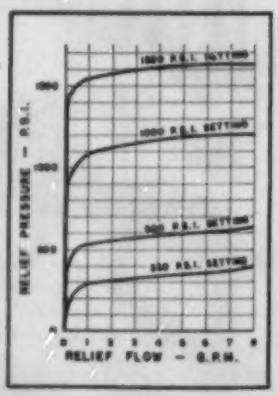

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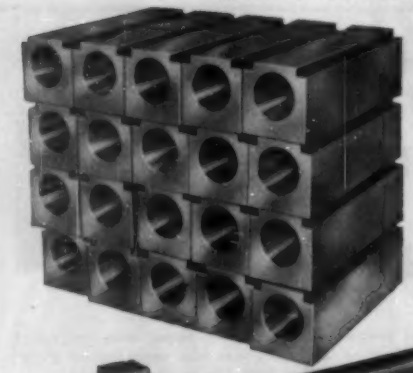

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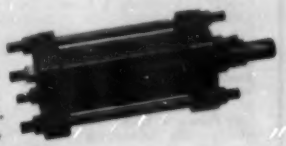

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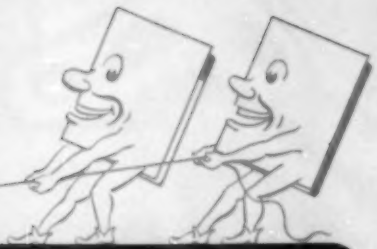

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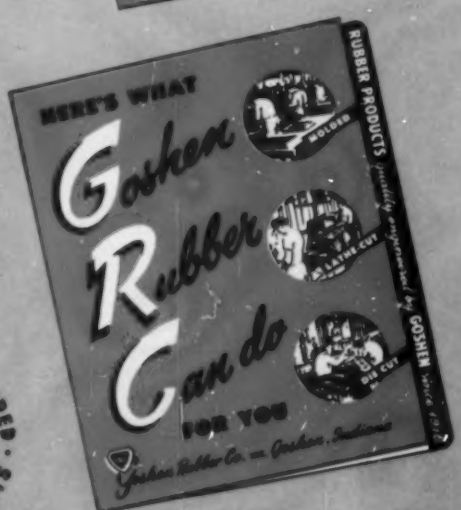

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